LJK17

intech mariner1600

HF SINGLE SIDEBAND RADIOTELEPHONE

2

INSTRUCTION & MAINTENANCE MANUAL

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LIMITED WARRANTY

Intech, Inc. ("Intech") warrants each new Intech Mariner 1600 including all parts and accessories supplied by Intech, to be free from defects in materials and workmanship under normal use for one year from the date of purchase by the original retail purchaser ("Warranty Period"). During the Warranty Period, Intech will repair or, at its option, replace this product without charge for parts or labor, if Intech has received the properly completed Warranty Registration Card, included in this manual, within 30 days from the date of purchase by the original retail purchaser.

This Warranty gives you the specific legal rights, and you may also have other rights which vary from state to state. ALL IMPLIED WARRANTIES WHICH MAY ARISE UPON THE SALE OF THIS PRODUCT, INCLUDING ANY WARRANTY OF MERCHANTABILITY, ARE LIMITED TO THE WARRANTY PERIOD. INTECH IS NOT RESPONSIBLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES CAUSED BY THE BREACH OF ANY WARRANTY, WHETHER EXPRESS OR IMPLIED. Some states do not allow limitations on how long an implied warranty lasts and some states do not allow the exclusion or limitation of incidental or consequential damages; so the above limitations or exclusions may not apply to you.

This Warranty extends to all persons who become original owners of this product during the Warranty Period, but in no event shall Intech's obligations extend beyond the Warranty Period.

This Warranty is the only express warranty which accompanies the sale of this product. This Warranty does not apply to any Intech product damaged in transit for repairs or by negligence, accident, or unreasonable use, nor to any product that has been repaired or altered other than by Intech so as to affect adversely its performance and reliability.

To obtain performance of the duties under this Warranty, the owner must:

1. Complete the Warranty Registration Card, included with this manual, and mail it to Intech at the address stated on that Card within 30 days of the original retail purchase;
2. Provide proof of the purchase date, such as a copy of the sales receipt or cancelled check;
3. Include a note describing the nature of the problem; and
4. Send the Intech product, securely packaged, postage or freight prepaid, to Intech Inc., 282 Brokaw Road, Santa Clara, CA 95050, Attention: Service Department.

(If the unit is sent to the United States from a foreign country, send it parcel post marked "Product of U.S.A. - Return for Repair".)

Intech's obligation to make such repairs after the one year warranty period is subject to its sole determination that such repair is feasible. This offer to repair does not apply to equipment damaged due to misuse or unauthorized alteration.

Intech Inc. reserves the right to modify or change the equipment in whole or in part, at any time prior to delivery, in order to include refinements deemed appropriate without incurring any liability to incorporate such changes in previous production units.

END OF WARRANTY

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SUMMARY OF ILLUSTRATIONS

1. GENERAL INFORMATION

1.1 DESCRIPTION

The Mariner 1600 is a compact, all solid-state, 150W PEP, HF SSB Transceiver for the Marine and HF Radio Service.

The set covers the frequency range from 2 to 23MHz with no frequency restrictions on receive or transmit. The channel capacity is 12 semi-duplex or 24 simplex or any combination. The upper sideband is transmitted. The channel frequencies are controlled by precision crystals that are housed in a proportional controlled crystal oven. Programming of each channel is accomplished with slide switches. A separate filter is used to allow true AM reception on so programmed channels. The transceiver works off a 12V DC negative ground system. The RF impedance is 50 ohms and is compatible with the Mariner 1605 Antenna Coupler or trap antennas.

1.2 EQUIPMENT FURNISHED

1.2.1 Mariner 1600 Radiotelephone.

1.2.2 Microphone and Microphone Clip.

1.2.3 Mounting Bracket.

1.2.4 6-Pin Power Connector (P/N 1430 5039).

1.2.5 18-Pin Control Connector to Antenna Coupler (P/N 1430 5038).

1.2.6 Instruction and Maintenance Manual.

1.2.7 Sheet of Frequency Markers (P/N 5315 7037).

1.3 OPTIONS AND ACCESSORIES

1.3.1 Crystals, one per channel (Intech Crystal Specification 1616 XXXX).

1.3.2 Power Supplies: PS135 115/220V AC, 13.6V DC, 20 Amps
PS136 20 to 50V DC, 13.6V DC, 20 Amps

1.3.3 Antenna Coupler, Mariner 1605.

1.3.4 Handset, H177.

1.3.5 Control Cable, #22 Gauge, 20 Wires (P/N 3640 0007, CC-20).

1.3.6 Power Cable #8 Gauge, 2 Wires (P/N 3640 0006).

1.4 MECHANICAL INFORMATION

Size: 40.6cm W x 14cm H x 35.6cm D
16" W x 5.5" H x 14" D

Weight: 8.2 kgs. or 18 lbs.

Mounting Position: Any Orientation

1.5 ELECTRICAL SPECIFICATION

1.5.1 GENERAL

Type Acceptance	FCC Parts 81, 83, 89, 91
Frequency Range	2 to 23MHz
Circuitry	Dual Conversion (45MHz, 455kHz)
Channel Capacity	24 Simplex or 12 Semi-duplex or any combination.
Front Panel Controls	Volume ON/OFF, Clarifier, Squelch/RF Gain, AM/SSB, A/B Channel, Channel Selector.
Operating Temperature Range	-30 to +60°C
Frequency Stability	20Hz
Operating Modes	A3A, (SSB -16dB Carrier) A3H, (AME -3 to -6dB Carrier) A3J, (SSB -40dB Carrier)
Primary Voltage	13.6V DC ±15%, Negative Ground
Current Drain	
Receive Standby	1A
Receive Full Audio	1.5A
Transmit Average Voice	10A
Transmit Two Tone	18A
RF Impedance	50 Ohms

1.5.2 TRANSMITTER

Power Output (into 50 Ohms)	A3A, A3J, 150W PEP A3H 40W PEP
Intermodulation	-32dB below PEP
Spurious Emmissions	-64dB below PEP
Carrier Supression	-46dB below PEP (A3J)
Undesired Sideband Supression	-60dB below PEP
Audio Response	300Hz to 2400Hz, ±3dB

1.5.3 RECEIVER

Sensitivity:	SSB	1μV for 12dB SINAD, 500mV Audio
	AM	3μV for 12dB SINAD, 500mV Audio
Selectivity:	SSB	-6dB 300Hz to 2400Hz, -60dB @ 4kHz
	AM	-6dB @ ±6kHz, -60dB @ ±16kHz
AGC		Audio output varies less than 10dB for signals between 10μV and 100mV, fast attack, slow release.
Intermodulation		At least -80dB
Spurious Responses (incl. Image)		At least -60dB
Clarifier, uniform on all channels		±150Hz
Noise Limiter		Diodes
Audio Power		4 watts at less than 10% distortion

2. OPERATION

2.1 WARM-UP CAUTION

Do not attempt to transmit until the radiotelephone is warmed-up for at least 10 minutes. Transmitting before the 10 minute warm-up period has elapsed can cause a violation of FCC Regulations.

2.2 FCC REQUIREMENTS

Before a SSB radiotelephone can be licensed, a VHF radio set has to be installed. A valid ship station license, in addition to an operators license, is required to operate a radiotelephone. FCC forms #502 and #753A can be obtained from an Intech dealer or direct from the factory. Aliens can obtain form #755 from the nearest FCC office.

2.3 OPERATING PRACTICES, FCC PARTS 81 AND 83

"How to Correctly Operate Your Radio Telephone Set" is a booklet available from the Radio Technical Commission for Marine Service (RTCM), P.O. Box 19087, Washington, D.C. 20036 and is highly recommended reading material.

2.4 FRONT PANEL CONTROLS AND INDICATORS

Figure 1 illustrates the front panel of the Mariner 1600. The function of these controls are as follows:

- Volume/Off: This control adjusts the loudness of the receiver and turns the set on and off. To turn the set ON, turn the Volume/Off control knob CLOCKWISE until a click is heard. Turning the control knob further clockwise will increase the receiver volume level.

- Clarity/Lamp: This control varies the frequency of the receiver ±150Hz to allow the operator to compensate for off-frequency signals. When the control is set to mid-range, the frequency of the receiver is approximately correct for that channel. The lamp control is a pull type switch on the clarity control knob which allows the operator to actuate a small panel lamp behind the channel frequency placard. To actuate the lamp, pull the clarity/lamp control knob out.

- Squelch/RF Gain: This potentiometer sets the squelch threshold in the push-in position. With the control in the pull-out mode, the RF gain level can be set.
  Note: At any one time only one of these functions can be exercised.

- AM/SSB Switch: Allows the operator to receive AM or SSB on a A3H(AME) Channel. 2182 is the only legal A3H Channel in the U.S.

- A/B Switch: This control is used to obtain two frequencies on one position of the channel selector. It is only operational when the channel is internally programmed for simplex operation.

- Channel Selector: Used to select desired operating frequency.

- Frequency Display: Indicates the station (i.e., WOO 4-1) or frequencies associated with a particular selector position.

A Green and Yellow LED show whether the A or B frequency is in use on a particular switch position.

A Red Lamp behind the dial indicates that power has been applied to the transmit circuits.

Illumination for the window is provided by a light bulb activated by pulling the clarifier knob.

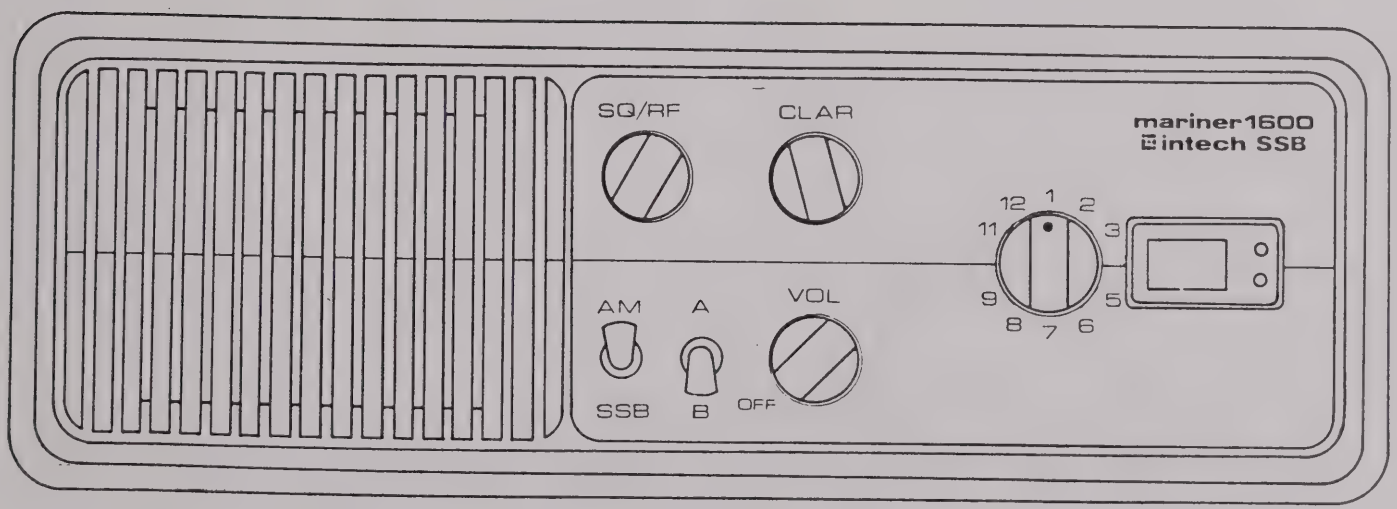


Fig. 1

2.5 PROPAGATION

HF signals do propagate for beyond the horizon. MF frequencies (2-3MHz) are generally usable within 300 miles depending on the daytime, atmospheric and man-made noise.

The High-Seas frequencies (4, 6, 8, 12, 16, 22MHz bands) allow communications over thousands of miles, again subject to the above mentioned limitations. Interference tends to be more of a problem than on VHF.

2.6 OPERATING THE TRANSMITTER

The operation of the transmitter is fairly straight forward. Do not shout into the microphone as it will decrease intelligiblity. Acknowledgement of a message cannot be done by keying the microphone since no signal is transmitted until the operator actually speaks.

3. PROGRAMMING

3.1 FREQUENCY AND MODE SELECTION

The Mariner 1600 may be programmed by small DIP program switches as marked on the oscillator board. There are 24 of these small slide switches contained in 4 DIP packages. 12 of these switches select the semi-duplex or simplex, while the other 12 determine A3A, A3H or A3J (see Figure 2.) As of January 1, 1977 the only frequency where A3H (AME) may be used in the U.S. is 2182kHz, the international distress and calling frequency.

3.1.1 A3H (AME), CHANNEL 1

Jumper #1 (Figure 2) is required and normally factory installed.
On transmit, the carrier is reinserted 3 to 6dB down from PEP. The level is set by R211. The receive mode is determined by S2, a front panel control. In the AM mode regular double sideband is received, while on SSB the upper sideband only is processed.
Simplex or duplex are set according to the operational requirements. (Simplex for 2182.)

3.1.2 A3J, (SSB) SEMI-DUPLEX

This mode is used with the U.S. Coast Guard AMVER frequencies. The carrier is fully surpressed, transmit and receive are on different frequencies. Duplex/Simplex switch is moved to duplex (towards the back) and the 16dB/SSB switch forward to SSB (see channel 2, figure 2).

This set up is also used for receive only frequencies like WWV or CHU. Do NOT install a transmit crystal.

3.1.3 A3A, -16dB, SEMI-DUPLEX

The Duplex/Simplex and the 16dB/SSB switch are moved towards the back of the set (see channel 3, figure 2). The carrier is about 3 watts, 16dB down. Receive is SSB. This mode is used with the public coast stations.

3.1.4 A3J, SIMPLEX

The Duplex/Simplex and the 16dB/SSB switch are moved toward the front of the set. Transmit and receive are on the same frequency, the carrier is fully surpressed. Limited coastal station and ship to ship frequencies are used this way (see channel 4, figure 2).

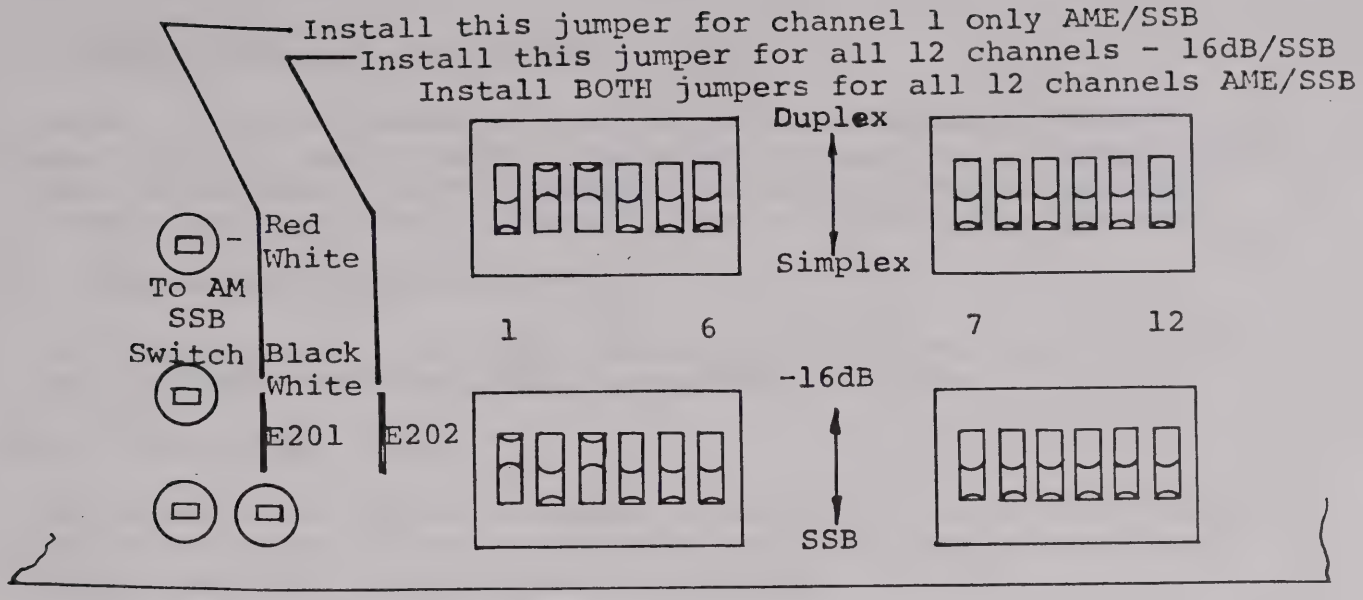


Fig. 2

3.2 BANDWIDTH LIMITATIONS

The only limitation imposed by the Mariner 1600 is that A/B frequencies have to be within the same low pass filter range. There are 4 ranges: 2-3.4, 4-6.9, 8-13 and 16-23MHz. Very likely the antenna system used will dictate the maximum allowable frequency separation.

3.3 CAUTION, FREQUENCY TOLERANCE

Under FCC Part 83 (ship stations), the maximum frequency tolerance is ±50Hz, while shore stations (Part 81 are only allowed ±20Hz. To achieve this accuracy, a frequency counter with a long term stability and accuracy of 2-5Hz should be used.

All work effecting the transmitter performance must be carried out by or under the supervision of a person holding at least a second class FCC radio-telephone license.

3.4 CRYSTAL LOCATION

Crystals, per Intech Specification 1616 XXXX, are inserted into the proportional control crystal oven. There is room for 24 crystals. The A crystal on simplex or receive crystal on semi-duplex is in the front socket. The rear socket is occupied with the B crystal on simplex or the transmit crystal on semi-duplex (see figure 3). A mylar label on the oven cover permits the recording (with pencil or ink) of the crystal frequencies for quick reference. Two light emitting diodes (LED) are provided, green (CR217) and yellow (CR224), which indicate the capacitor bank to be adjusted.

3.5 SETTING THE CRYSTALS ON FREQUENCY

Hook-up a frequency counter to J 201 of the oscillator board. There is about 0.3 V p-p signal present. The crystal frequency is 1.750000MHz higher than the operating "carrier" frequency. Setting the frequency to within 2-5Hz is desired. Allow 20 minutes of warm-up for crystals in the oven.

3.6 THE CARRIER AND USB FREQUENCIES

It is good practice to check the frequency of the carrier crystal 455.00kHz and 2.205000MHz USB crystal while re-channeling the radio.

3.6.1 THE 455.00kHz CARRIER

The oscillator and crystal are located on the IF Audio Board (A1). TP7 allows for an easy hook-up of the counter. The signal amplitude is about 2V p-p. C116 is used to set this oscillator on frequency.

3.6.2 THE USB OSCILLATOR, 2.205000MHz

This oscillator is located on the A4 UP-DOWN Converter Board. TP1 (Figure 4) located at the junction of Q11 emitter and R32 allows the hook-up of a frequency counter. 200-300mV p-p are typical.

On receive, the clarifier control can change the frequency by about ±150Hz. R439 sets the frequency on transmit.

If any long term aging, in either oscillator, occurs that can no longer be corrected with the respective capacitor, correct the other frequency by the same amount. Assume the 455kHz oscillator is 75Hz high, then simply set the USB oscillator high by 75Hz with R439.

3.7 THE ANTENNA LOW PASS FILTERS

The low pass filter in use is selected by Wafer #7 and #8 of the channel selector switch. Figure 5 shows the wiring diagram. The channels are grouped in sets of three. Any set of the three can be assigned to any one of the low pass filters with the help of two terminal strips located on the top and bottom of the set. A cut and resolder need only be made if, for instance, switch position 1 and 2 are used on 2-3MHz; 3, 4, 5 and 6 on 4MHz; etc.

If a wrong low pass is selected; e.g., 4MHz into the 2-3.4MHz section, the filter can be destroyed since the RF energy is converted into heat. Conversely, a too high filter attenuates harmonics not enough and can result in a FCC violation notice.

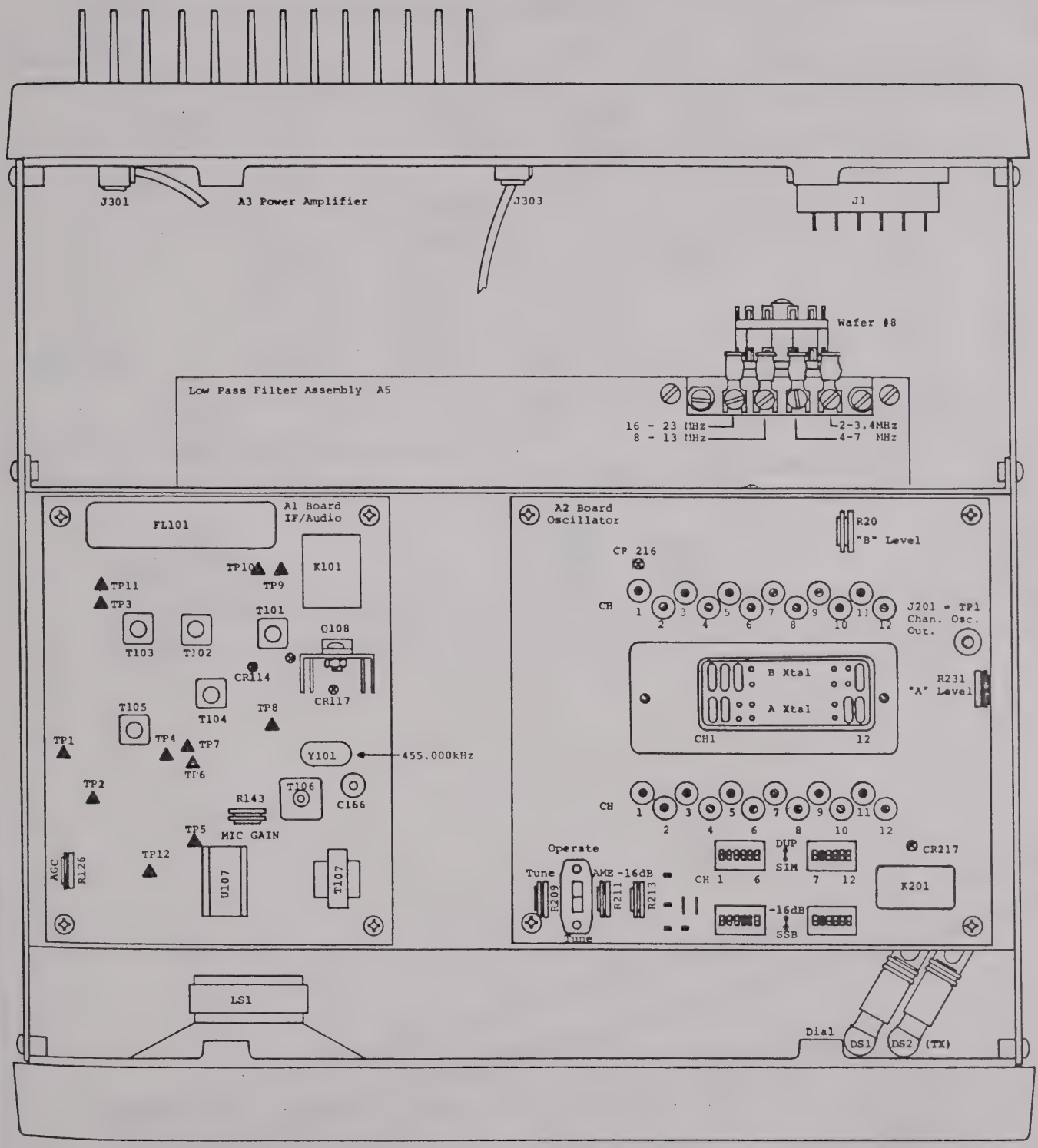
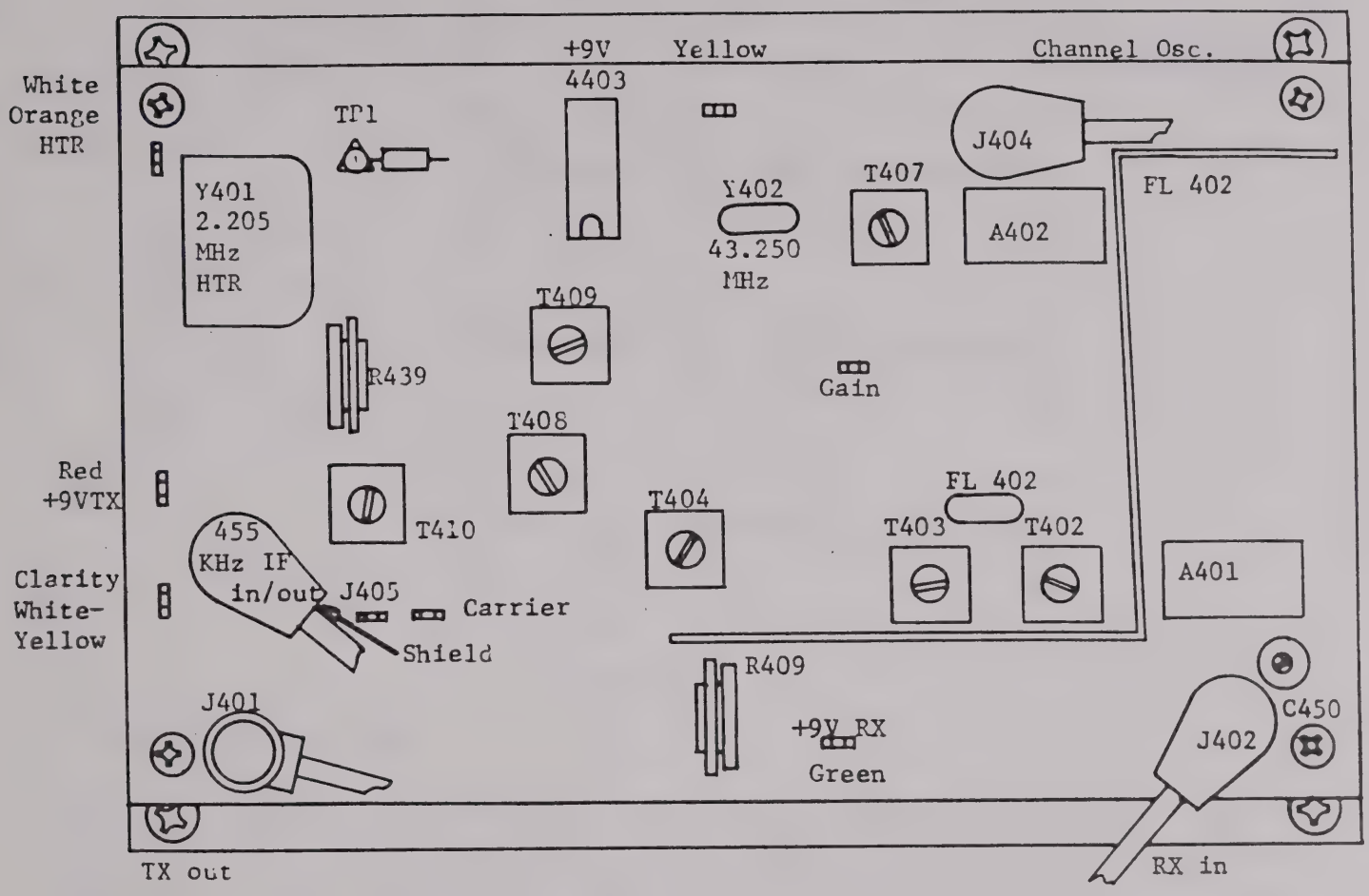

J301
A3 Power Amplifier
J303
J1
Wafer #8
Low Pass Filter Assembly A5
16 - 23 MHz
8 - 13 MHz
2-3.4MHz
4-7 MHz
A1 Board
IF/Audio
FL101
K101
TP10
TP9
TP11
TP3
T101
T103
T102
Q108
CR114
CR117
T105
T104
TP8
TP1
TP4
TP7
TP6
Y101
455.000kHz
TP2
T106
C166
R143
MIC GAIN
TP5
TP12
AGC
R126
U107
T107
A2 Board
Oscillator
R20
"B" Level
CR 216
CH
J201 = TP1
Chan. Osc.
Out.
B Xtal
A Xtal
R231
"A" Level
CH1
12
Operate
Tune
AME -16dB
R209
R211
R213
DUP
SIM
CR217
K201
-16dB
SSB
LS1
Dial
DS1
DS2
(TX)

Fig. 3



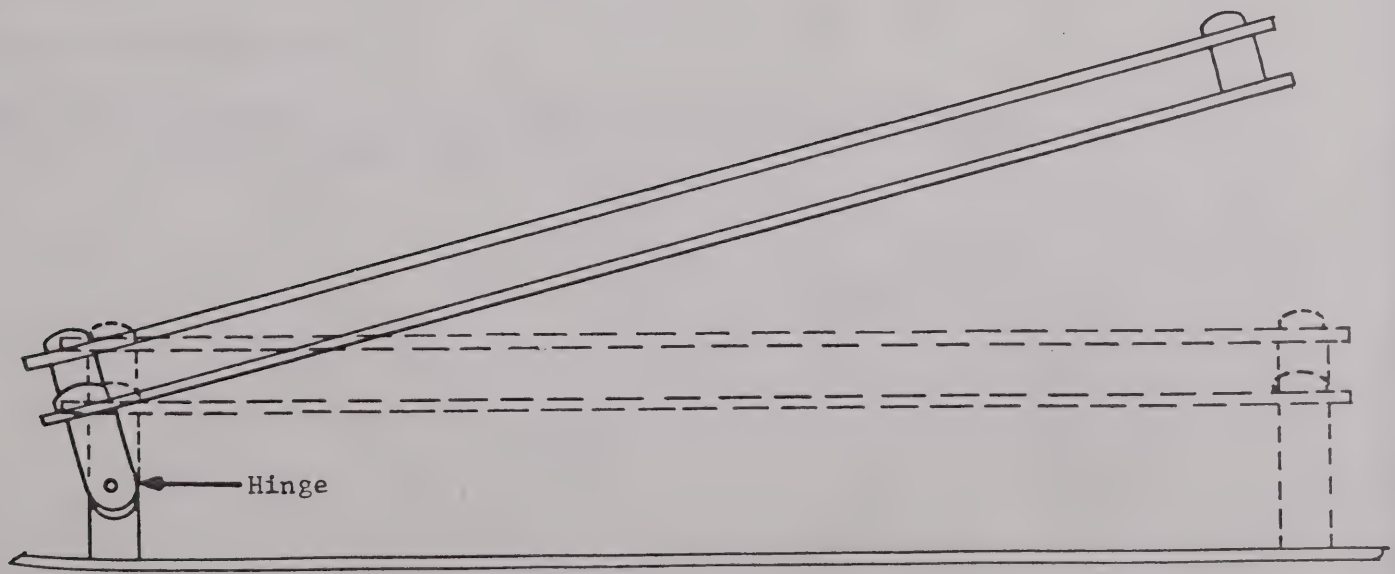


Figure 4 M-1600 A4 Board

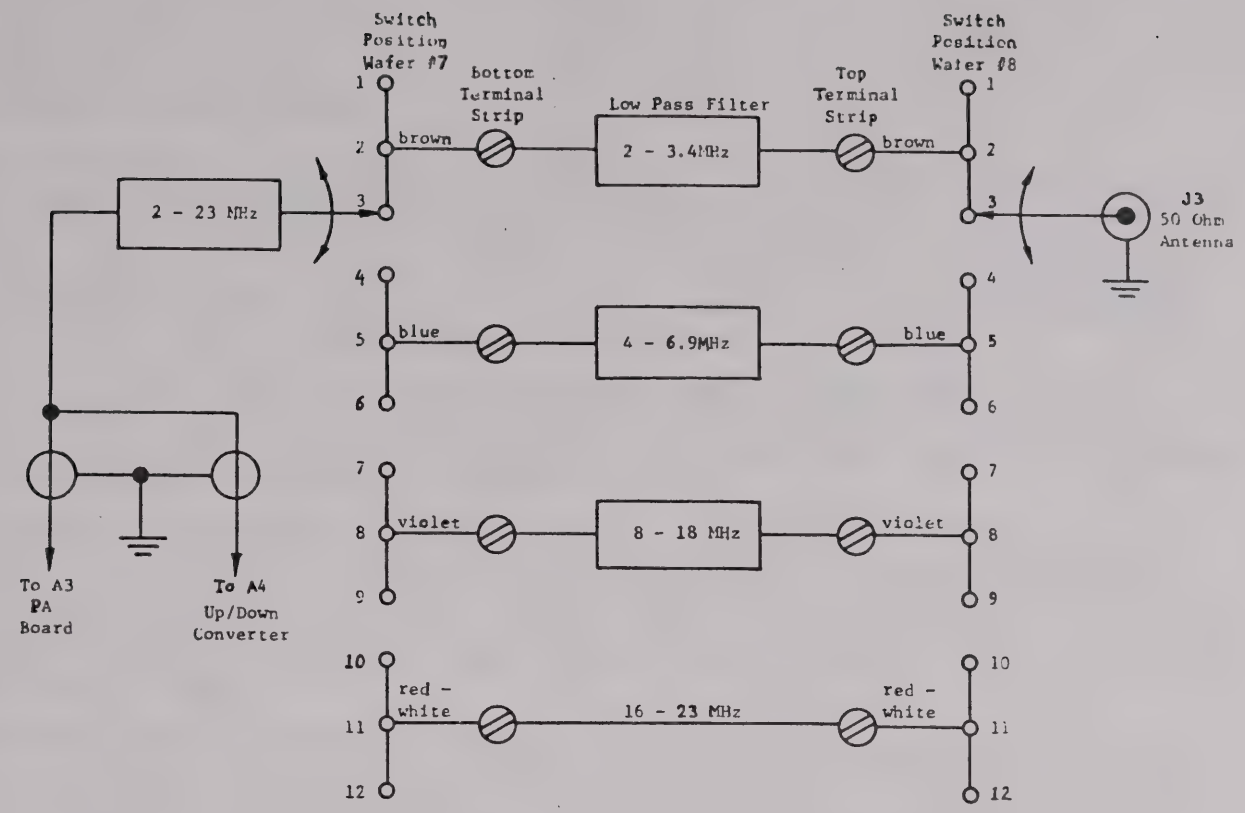


Fig. 5

3.8 FINAL FREQUENCY CHECK

After all crystal frequencies have been set, it is highly recommended to check the final frequency with a counter. Transmit into a 50 ohm artificial antenna. Hook-up the counter with a 10:1 probe to J3, the antenna connector. On A3J channels, the tune switch can be used to insert a carrier to excite the counter.

3.9 OUTPUT TO THE ANTENNA COUPLER

A ground potential is applied thru Wafer #5 thru connector J1 to control the Mariner 1605 antenna coupler with the help of 12 wires. No programming is required.

3.10 SPARE PROGRAM WAFER

Wafer #6 is provided as a spare allowing the hook-up, for instance, of a trap antenna on certain channels, etc.

3.11 DIAL INDICATOR MARKING

To apply indicator marking to the select dial, a label sheet has been provided. This sheet has an adhesive coating which is covered by a thin protective cover. The sheet will accept pencil, ink of any kind, or typing. For protection, a clear acrylic spray or a piece of tape, such as Scotch Magic Transparent Tape No. 810, can be used. If the markers on the sheet have been lost or misplaced, the above tape can be used in place of the markers.

Once the markers have been prepared and cut from the sheet, the protective cover should be removed and the markers placed on the dial in the proper location. The dial is marked to show the position of each marker. The numbers on the dial correspond with the channel numbers.

Two methods are available to add the markers to the dial. For the first, the channel illumination and transmit light holders must be removed and the dial set screws loosened. By pushing the dial back until it touches the chassis, the dial face will be accessable. Tweezers should be used to position the markers and care must be taken that they are not put on at an angle or outside the locating wedges.

The second method requires the removal of the dial. Set the channel marker knob to eleven. Loosen the set screws holding the shaft coupler to the shaft and the dial to the shaft. Remove the shaft by pulling it through the front panel. Some resistance may be encountered by the switch decks soldered to the A2 board. A slight back and forth motion on the switch decks will aid in the shafts removal. Once the markers have been added to the dial, the shaft can be re-inserted and the set screws tightened. Care should be taken to put the marker position eleven in the window of the front panel before tightening the dial set screws.

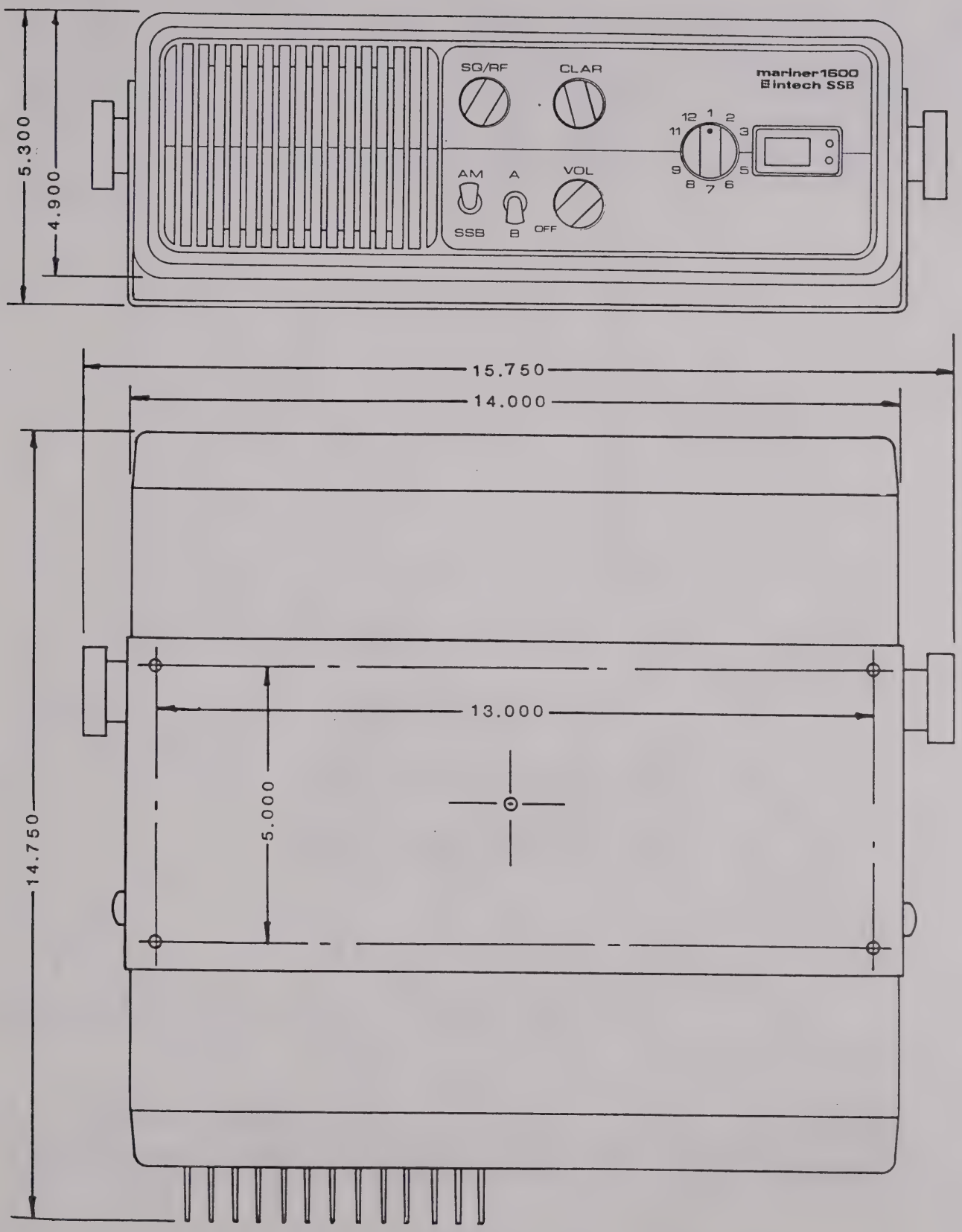

5.300
4.900
SQ/RF
CLAR
mariner1600
Eintech SSB
12 1 2
11 3
9 5
8 7 6
AM
A
VOL
SSB
B
OFF
15.750
14.000
13.000
5.000
14.750

Fig. 6

4. INSTALLATION

4.1 MOUNTING THE MARINER 1600.

The Mariner 1600 is compact enough to allow great flexibility in location, even on smaller vessels. Several options for mounting are available. The mounting bracket fits underneath or on top of the transceiver for bulkhead, overhead, or shelf locations. Fig. 6 shows the outline dimensions of the Mariner 1600 and bracket mount. The bracket can be used as a template to locate the mounting holes. When choosing the location for the radio set, take care to avoid areas directly over a heater or lacking adequate ventilation. In particular, avoid blocking air flow around the heatsink fins on the rear panel of the Mariner 1600.

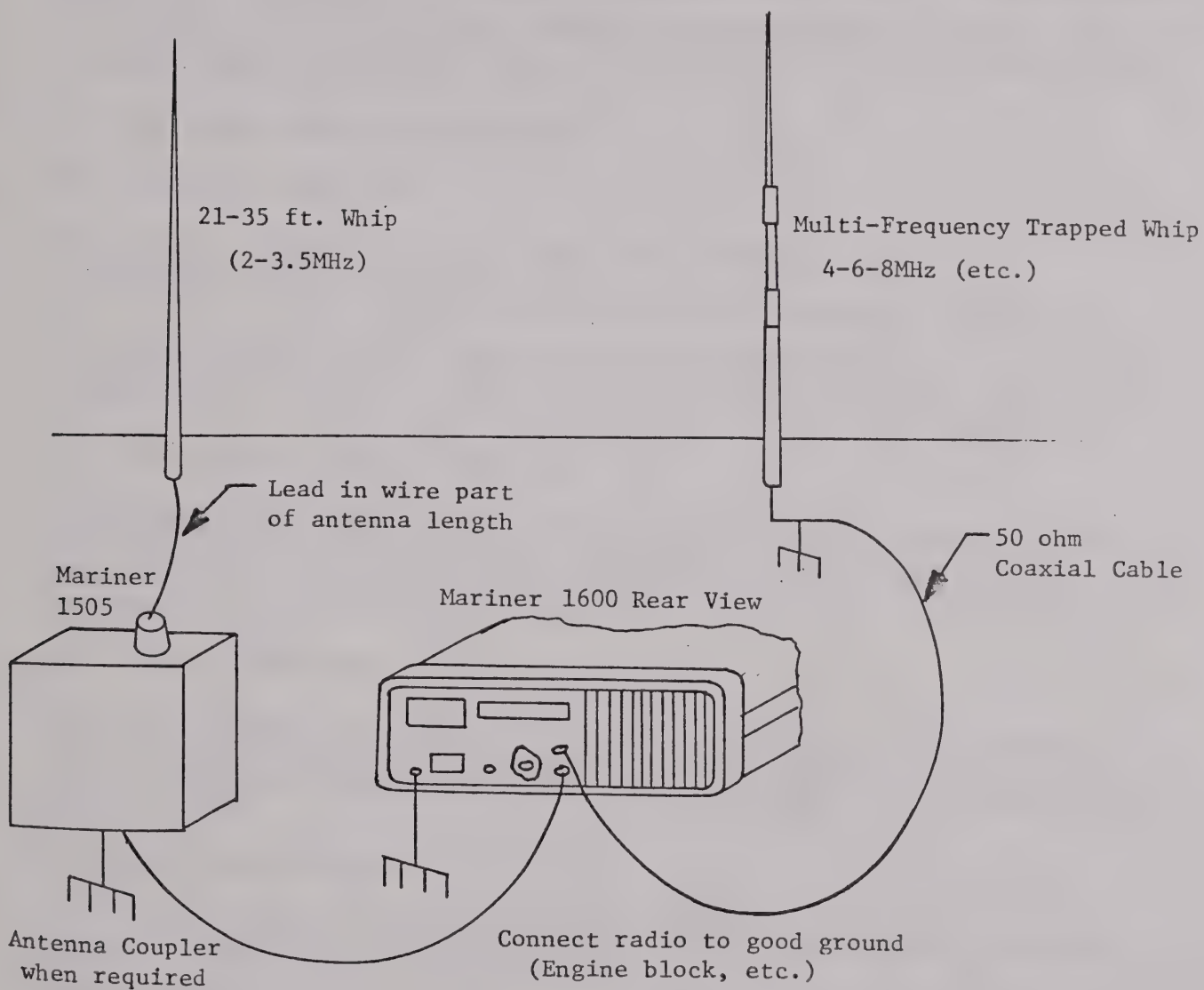


Fig. 7

4.2 A TYPICAL INSTALLATION

Figure 7 shows a typical installation consisting of three parts: (1) The radio equipment; (2) Interconnecting cables; (3) The antenna system.

Any radio communications system operating in the MF-HF spectrum must have an adequate ground connection, otherwise the overall efficiency of the radio installation is degraded. In extreme cases, it may be impossible to properly load the radiotelephone into the antenna.

The 50 ohm output impedance of the Mariner 1600 makes it necessary to employ antennas of the trapped or externally matched type. The use of a Mariner 1605 antenna coupler in conjunction with a simple wire or loaded whip antenna allows an efficient installation which will cover both the MF and HF bands. The antenna coupler was designed specifically for marine applications and will easily interface with the Mariner 1600 radio set.

On wooden or fiberglass boats, the use of a copper ground plate or the keel on a sailboat perform adequately. The ground system MUST be joined to the antenna coupler with a heavy copper strap.

4.3 REAR PANEL CONNECTIONS AND FUSES (See Fig. 8)

4.3.1 THE POWER CONNECTOR

Pin 1 and 2: Parallel, ground, minus side of battery.
Pin 3 and 4: Parallel, positive side of battery.
Pin 5 and 6: Remote ON/OFF, isolated from set, activated by VOLUME pot.

For less than 10 feet, #8 cable can be used; over 10 feet, use #6; and more than 20 feet should not be used. Use a direct run to the power source. If a power supply is used, place it as close as practical to the radio set.

4.3.2 THE ANTENNA COUPLER CONNECTION

The Mariner 1605 antenna coupler is controlled thru this connector. Use 20 wire cable, Intech P/N 3640 0007 or equivalent. If no antenna coupler is used be sure to short Pin 14 and 15 together since the PTT circuit is normally interlocked thru the antenna coupler.

4.3.3 THE RF CONNECTORS

Two UHF connectors are provided. With one antenna system, the connector marked "Antenna" is used. The connector marked "Spare" would be used in a system using two antennas. The most often used cable is of the RG-8A/U and RG-58C/U type.

4.3.4 THE TERMINAL STRIP

The terminal strip is provided to install an extension (simple remote), an external loudspeaker, or a handset.

Terminal Function:

AF - Output of the audio amplifier, AC coupled. Speaker impedance to be used is 3 ohms or more.

SPKR - Internal speaker input. A jumper to AF is needed to operate the internal speaker.

MIC - Input for a carbon microphone in parallel with supplied palm microphone which may need to be disconnected.

PTT - Input to the transmitter keying circuit. By applying ground potential, the PTT relay is activated. Interlocked thru Pin 14 and 15 of the antenna coupler control connector.

GND - Access to the negative side (ground) of the primary supply.

4.3.5 FUSING

Two fuses are provided:

A main fuse, 25A slo-blo, protecting mainly the RF power amplifier. Intech P/N 3002 0014 or Bussman No. MDR25.

A 3A quick-blo protecting the rest of the set. Intech P/N 3002 0015 or Bussman No. AGC-3, 250V.

4.3.6 THE GROUND CONNECTION

A bolt and nut are provided to hook-up the Mariner 1600 to the engine block, the keel, or similar ground.

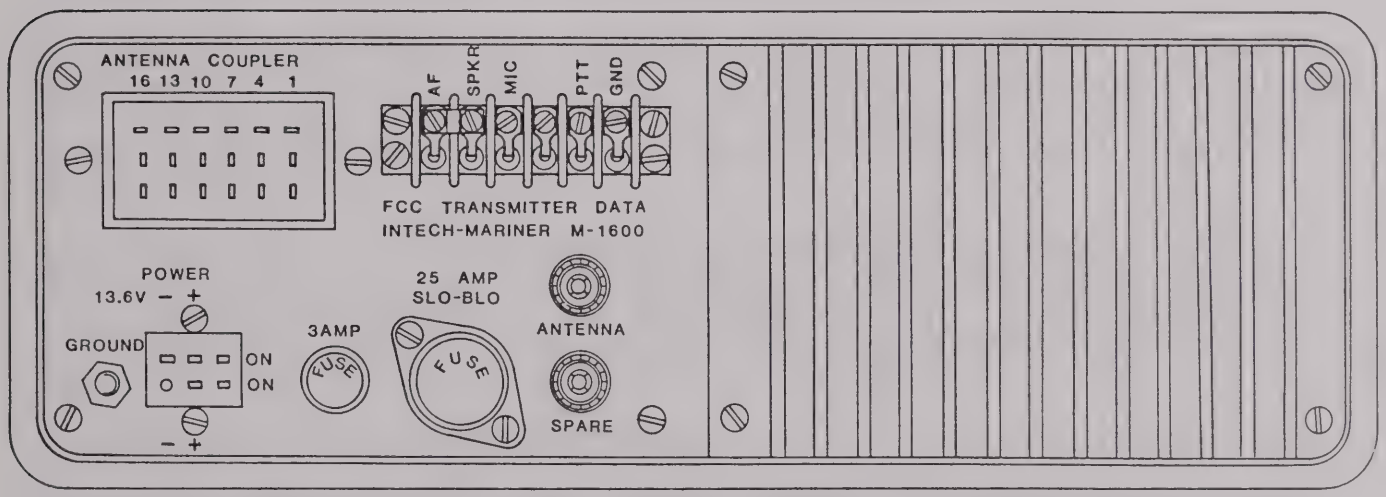


Fig. 8

5. THEORY OF OPERATION

5.1 GENERAL

The Mariner 1600 is a double conversion SSB HF Transceiver. Certain circuits perform the same function in receive and transmit (bilateral design). The first intermediate frequency (IF) is 45MHz and permits the use of a low pass filter to provide excellent image, spurious and harmonic rejection. A broad band design approach results in a minimum of tuned circuits. The second IF of 455kHz allows the use of a mechanical filter for sideband selection.

The Mariner 1600 also utilizes a unique UP-DOWN converter that includes frequency error cancellation in the 45MHz IF circuitry. The frequency stability is then strictly a function of the channel oscillator which operates at 1.75MHz above the channel frequency.

5.2 THE RECEIVER

5.2.1 BLOCK DIAGRAM

Figure 9 shows the block diagram in the receive mode.

The receive RF signal is routed from the antenna jack, J3, thru a set of switchable low pass filters to remove spurious responses. The signal then passes thru the T-R relay K101 (A1/IF Audio board) and on to a low pass filter and balanced mixer on the A4 board, the UP-DOWN converter.

By injecting the 47-68MHz local oscillator into the other port of the balanced mixer, a 45MHz IF signal is obtained. A crystal filter provides the selectivity, while Q405 amplifies the signal. The IF is then subtracted in another balanced mixer from 45.455MHz and results in the second IF of 455kHz that is applied to the A1 IF/Audio board.

Thru programming the AM or SSB detector is selected. The IF strip consists of U101 and U102, I.C. amplifiers. At the output of U102 is a noise limiter, a fast attack, slow release AGC and the product detector. An electronic attenuator, U106, serves as a squelch gate and audio pre-amplifier for the 4 watt audio power amplifier U107.

5.2.2 RECEIVE RF CIRCUITRY AND FIRST MIXER

An incoming signal passes thru the low pass filter (A5 assembly) and on to the T-R relay located on the A1/IF board. A coaxial cable brings the signal to the A4 UP-DOWN converter. The +9V receive buss forward biases CR 402. Another low pass filter attenuates spurious responses further. A double balanced mixer, U401 assures minimal cross modulation and intermodulation.

REVISIONS					
SYM	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

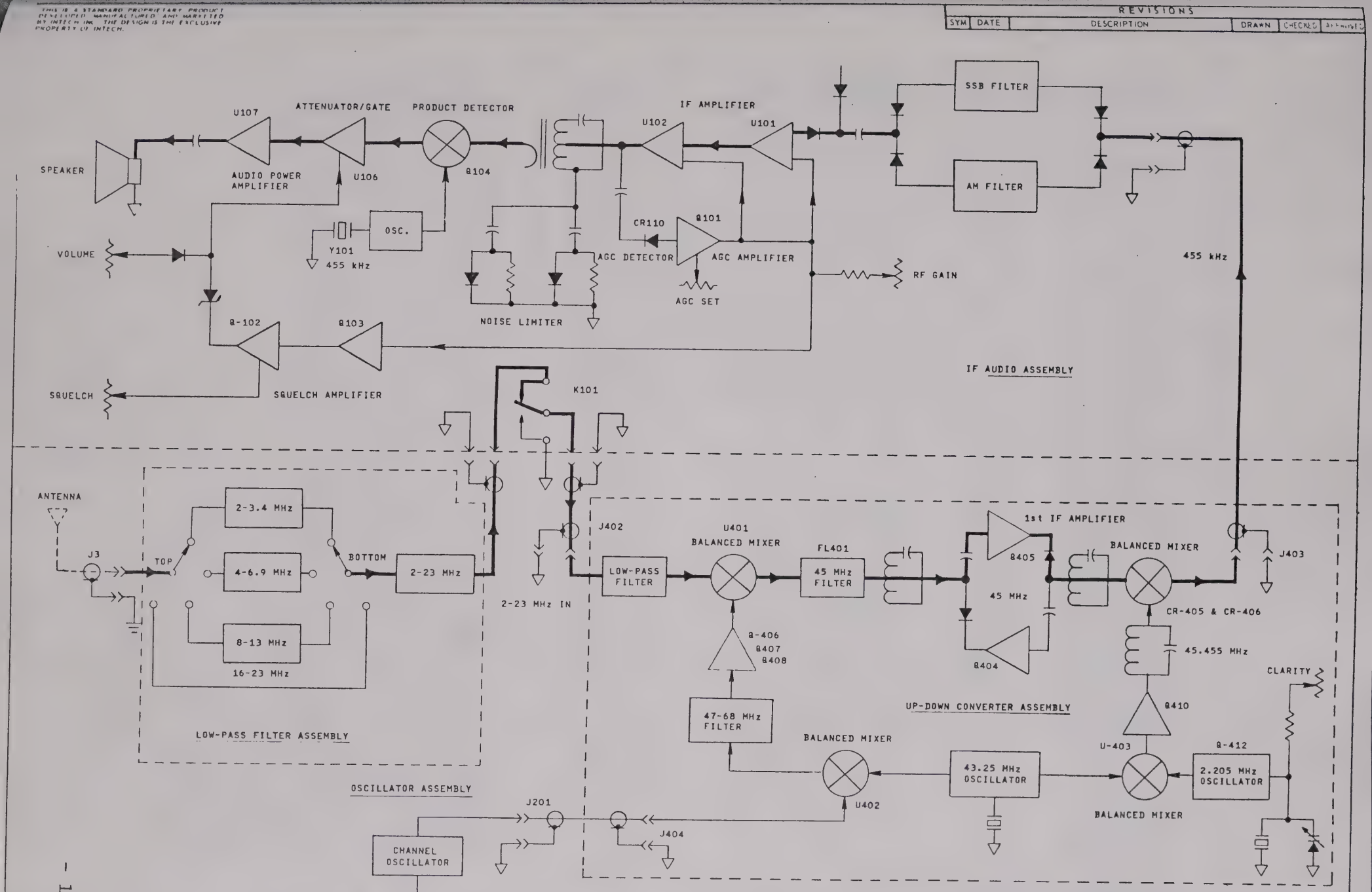


Fig. 9

QTY	NEXT ASSY	USED ON
		M-1600

DRAWN [illegible] DATE 2-17-77
CHECKED [illegible] 4/21/77
ENG
MFG
QA

intech INTECH INCORPORATED
SANTA CLARA
CALIFORNIA, 95050

TITLE
MARINER 1600
RECEIVE BLOCK DIAGRAM

SIZE	CODE IDENT NO	DRAWING NO	REV
C	33967	0-157264	A

SCALE NONE SHEET OF

5.2.3 THE 45MHz IF AND SECOND MIXER

At the output of U401 follows, FL 401, a monolithic 4 pole 45MHz crystal filter with a band width of about 20kHz. The IF signal is amplified by Q405 and passes on to a balanced mixer, consisting of hot carrier diodes CR 405 and 406 and transformer T405. This mixer is only single-balanced since narrow filters are at the input and output. Q404 transmit IF and Q405 receive IF amplifiers are switched in their circuits by CR 403 and 405 thru the +9V transmit and receive buss.

T410 is a transformer tuned to the second IF at 455kHz. From J403 the 455kHz signal is routed to the A-1/IF Audio board by a coax cable.

5.2.4 THE 455kHz IF FILTER (SSB/AM)

Two filters are provided; for SSB, a 455kHz mechanical USB filter (FL101) and for AM, T101, T102, and T103 are used. The programmed filter is switched in by CR101, CR103, or CR102, CR104. On SSB, the filter switch terminal is positive, activating the carrier oscillator and forward biasing CR101 and CR103. On AM, CR102 and CR104 are forward biased since the filter switch terminal is at ground potential. C115 and CR105 couple the signal to the receive IF amplifier. The R+ assures forward bias of CR105 thru R109. CR106 is reverse biased on receive. Test points 3, 9, and 11 all permit monitoring the performance at the filter switch.

5.2.5 THE RECEIVE IF STRIP

The receive IF strip consists of two intergrated circuits, U101 and U102, with a total voltage gain in excess of 100dB. TP3 is at the input of the IF, while the AGC voltage can be monitored at TP2. The RF gain potentiometer, R3, works in parallel with the AGC and if not activated, R11 is at ground potential.

5.2.6 NOISE LIMITER AND AGC

A noise limiter network is connected across the output IF transformer T105. The network consists of capacitors C127 and C128, resistors R118 and R119, and diodes CR107 and CR108. This limits the level of noise pulses across the primary winding of T105 preventing AGC "pump up" on impulse noise. The output of the IF amplifier is coupled to the AGC detector diode CR110 (TP1) and conducts to charge C126 to a voltage level equal to the peak voltage on T105. The release time constant is given by the product of C126 and R114 and equals about one second. Q101, an N channel junction FET, amplifies and inverts this peak voltage without discharging C126. R116 adjusts the "no signal" voltage at the AGC buss to about 3.5V. Increasing the signal level will increase the AGC voltage.

5.2.7 THE SQUELCH COMPARATOR

Q102 and Q103 are connected as a Schmitt-Trigger with inputs from the front panel squelch control and the AGC line. The front panel control establishes the set level for the Schmitt while the rising AGC voltage which accompanies an incoming signal "toggles" the circuit and removes the bias voltage holding U106 off. U106 operates at the gain level set by the volume control potentiometer.

5.2.8 THE 455kHz CARRIER OSCILLATOR

Transistor Q107, transformer T106, and crystal Y101 form the carrier oscillator circuit. Q107 is a high input impedance amplifier. Transformer T106 provides the necessary feedback to sustain oscillation and crystal Y101 provides the necessary stability on the carrier frequency of 455kHz. Output is taken from the low impedance winding of T106 and is fed to the emitter of the product detector (TP7). After suitable attenuation by resistors R144 and R145, a signal is also fed to the transmitter balanced modulator, U104. On AM receive, the oscillator is turned off by programming. The supply voltage for the oscillator can be checked at TP10. The 455kHz crystal is kept at a constant temperature with a "slip-on" proportional control oven assembly.

5.2.9 THE PRODUCT DETECTOR

The audio detection is performed by Q104, a high gain NPN transistor. It is biased to function as both a SSB product detector and an infinite impedance envelope detector for AM. On SSB, the locally generated 455kHz carrier is injected into the emitter (TP7). The carrier oscillator is disabled on AM. The audio output can be monitored at TP6.

5.2.10 THE AUDIO PRE-AMPLIFIER AND POWER STAGE

The audio amplifier consists of two I.C.'s, U106 and U107. The pre-amplifier has a voltage gain range from about +12dB to -70dB depending on the DC level set by the volume or squelch pot. Maximum gain occurs with about +3.5V at Pin 10 while maximum attenuation takes place with about +6V. The output of U106 can be monitored at TP5 which is also the input to the power amplifier, U107. The audio power stage produces 4-5 watts of audio at less than 10% distortion. Its typical voltage gain is 37dB. A heatsink is attached to the I.C. Under no signal conditions, about one half of the power supply voltage appears on Pin 12. C146 provides AC coupling to the loudspeaker.

5.3 THE TRANSMITTER

5.3.1 BLOCK DIAGRAM

Figure 10 shows the block diagram of the set in the transmit mode. The microphone signal is amplified by Q105, Q106 and applied to the signal port of a balanced mixer U104. Injected into the oscillator port is the 455kHz carrier oscillator. The resulting double-side band signal is amplified by U105, an ALC controlled IF amplifier. The output is then applied to a mechanical SSB filter that surpresses the lower sideband.

The 455kHz SSB signal is then applied to a balanced mixer formed by CR405, 406 with a desired output of 45MHz. A crystal filter further enhances the 45MHz IF. In the double balanced mixer U401, the transmit IF is mixed with the L.O. signal, resulting in the desired transmit output frequency. Q403, Q402 and Q401 amplify this signal further to the level required by the power amplifier board (A3). Depending on the operating frequency, low pass filters are switched in to attenuate harmonics. The output impedance is 50 Ohms.

5.3.2 MICROPHONE AMPLIFIER

T107, an input transformer, matches a low impedance carbon or dynamic microphone to the higher input impedance of the amplifier formed by Q105 and Q106. R150 provides DC current in the case of a carbon microphone, while C169 filters out any ignition noise, etc. on the +9V line. A potentiometer R143 sets the appropriate modulation level. TP8 monitors the output of the microphone amplifier.

Note: Make the following modifications for a dynamic microphone:

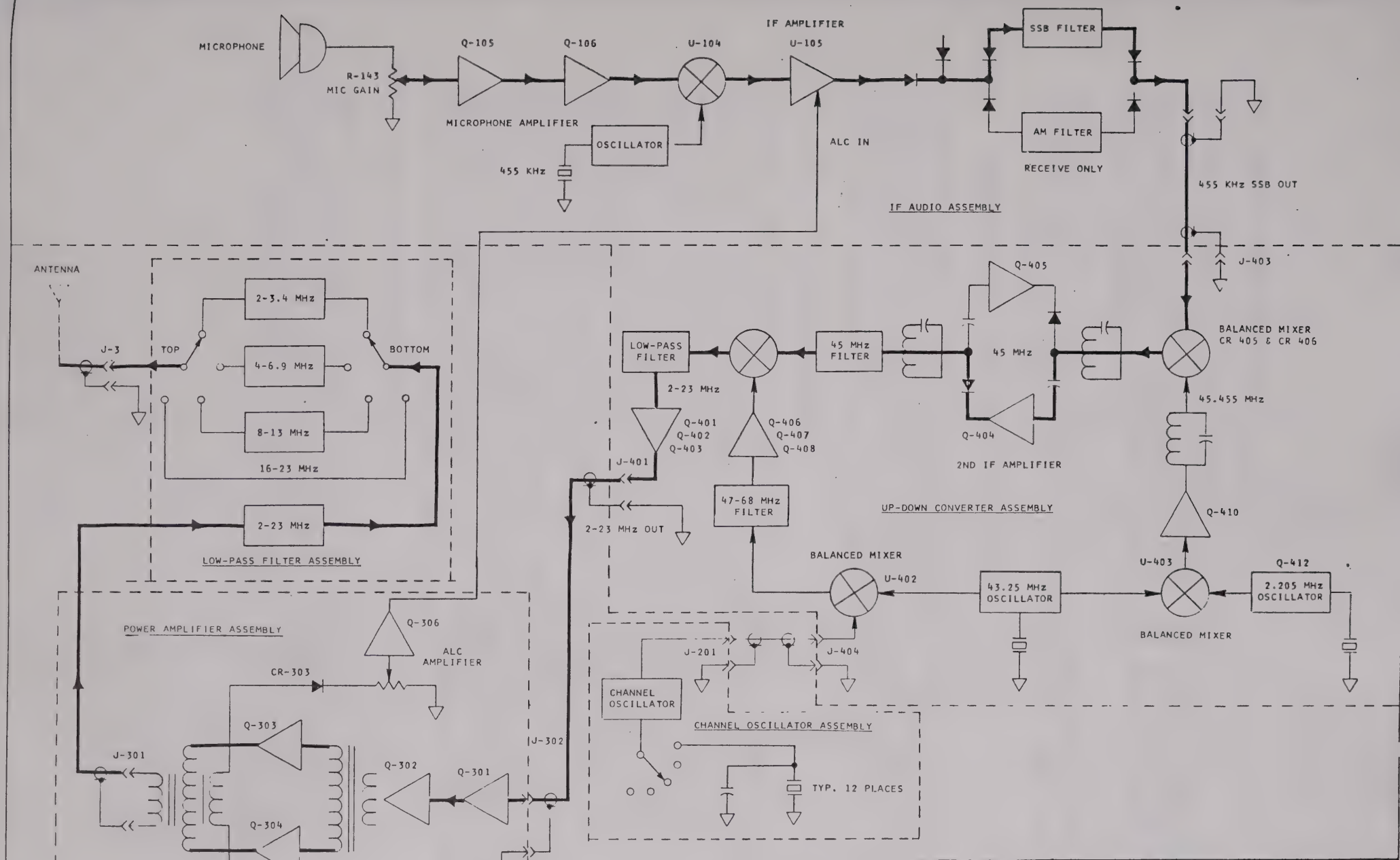
Remove R150, 470 Ohms
Short out R159, 100 kOhms

5.3.3 TRANSMIT BALANCED MODULATOR

Audio from Q105 (TP8) and the 455kHz carrier from Q107 (5.2.8) are combined in U104, an I.C. balanced modulator. This device needs no external balance control to provide at least 40dB carrier suppression. The output from U104 is a double sideband suppressed carrier signal at a frequency of 455kHz.

5.3.4 TRANSMIT IF AMPLIFIER

U105 is an I.C. that functions as a low gain IF amplifier/attenuator controlled by an ALC feedback voltage derived from circuitry in the final amplifier. This feedback insures that the drive level to the final amplifier does not become excessive and cause distortion.



QTY	NEXT ASSY	USED ON
		M-1600

Fig. 10

DRAWN [illegible] DATE 4-1-72
CHECKED [illegible]
APPROVALS: ENG [illegible] MFG [illegible] QA

intech INTECH INCORPORATED
SANTA CLARA
CALIFORNIA, 95050

TITLE: MARINER 1600
TRANSMIT BLOCK DIAGRAM

SIZE	CODE IDENT NO	DRAWING NO	REV
C	33967	0-157263	A

SCALE NONE SHEET 1 OF 1

5.3.5 FIRST TRANSMIT MIXER AND SECOND IF

The output of U105 is applied to FL101, a mechanical SSB filter. The upper sideband (USB) is applied thru T410 to a mixer consisting of CR405, 406. This mixer, by use of the 45.455MHz oscillator, converts the 455kHz (USB) signal. Since there are narrowband filters on the input and output, the mixer is only single balanced.

The 45MHz signal then is amplified by Q404. This amplifier and Q405 (Rx-45MHz IF) share common circuitry. They are switched in and out of the circuit by CR403 and CR404.

5.3.6 SECOND TRANSMIT MIXER AND BUFFER AMPLIFIER

A monolithic crystal filter attenuates undesided frequencies before the signal is applied to U401, a double balanced mixer. A suitable oscillator signal converts the 45MHz LSB to the desired RF frequency (USB). This frequency is amplified by Q401, 402, 403 to approximately 0.65V rms. The gain of the buffer amplifier is set by R409 TX-RF gain.

5.3.7 THE RF POWER AMPLIFIER (A3)

A coaxial cable conducts the TX-RF of the A4 board to the input (J301) of the A3 board, the RF power amplifier. Q301 and Q302 raise the power level to about 5 watts. The output of Q301 is coupled to the driver transistor Q302 through a toroidal wideband transformer T302. The use of heavy negative feedback in both Q301 and Q302 provides a flat frequency response and excellent linearity. Coupling between the driver stage Q302 and the push-pull final amplifier Q303, Q304 is accomplished thru T303. This transformer and the output transformer T304 are of a unique design. They make use of ferrite loaded tubular low impedance "windings" which have the higher impedance windings threaded thru the tubular members. This technique provides a transformer with excellent balance, frequency response and power handling capability. The push-pull power output stage in the Mariner 1600 employs a matched pair (Q303 and Q304) of high power RF devices biased into Class B operation for maximum efficiency and low distortion. This raises the power level to 150 watts PEP (Peak Envelope Power). The signal is routed thru channel switch contacts to an appropriate filter.

5.3.8 THE BIASING OF Q303 AND Q304

Biasing for the pair is provided from the Zener diode CR302 (10 volts) thru emitter follower Q307, a power transistor. A similar power transistor, Q305, is bonded to the P.A. heatsink, thus providing temperature tracking for the output transistor bias line. Idling current for the output stage, Q303 and Q304, is adjusted by R313 to about 200ma under no modulation conditions.

5.3.9 THE ALC CIRCUIT

A tertiary winding on T305 provides RF for the ALC feedback. CR303 and CR304 rectify the RF voltage and the resulting DC voltage appears across R325. Thru an emitter follower, Q306, a portion of it is applied to U105, an I.C. with dynamic range in excess of 50dB. This constitutes an effective way of controlling the maximum peak output of the transmitter.

6. MODE AND FREQUENCY CONTROL

6.1 GENERAL

Figure 11 shows a simplified schematic of the mode and frequency control circuitry.

6.2 TRANSMIT MODE SELECTION

There are three modes of transmission:

A3J (true SSB) with the carrier surpressed by at least 40dB.

A3A (SSB) with a pilot carrier 16dB below PEP.

A3H (AME or AM equivalent) with a carrier 3 to 6dB below PEP.

The basic mode of transmission is A3J. This mode of operation is used for ship to ship, base station to ship, and point to point communication.

A3A is used primarily for public correspondence channels. This allows the shore station to lock on to the pilot carrier with an autotune receiver.

A3H is an interim method of emission during the change over from AM to SSB. It is not very effective, but does allow communications between AM and SSB equipped vessels. As of January 1, 1977, the only frequency where A3H may be used in the U.S. is 2182kHz, the international distress and calling frequency.

Programming the Mariner 1600 for these modes of transmissions is accomplished with 2 DIP switch packages (Fig. 2).

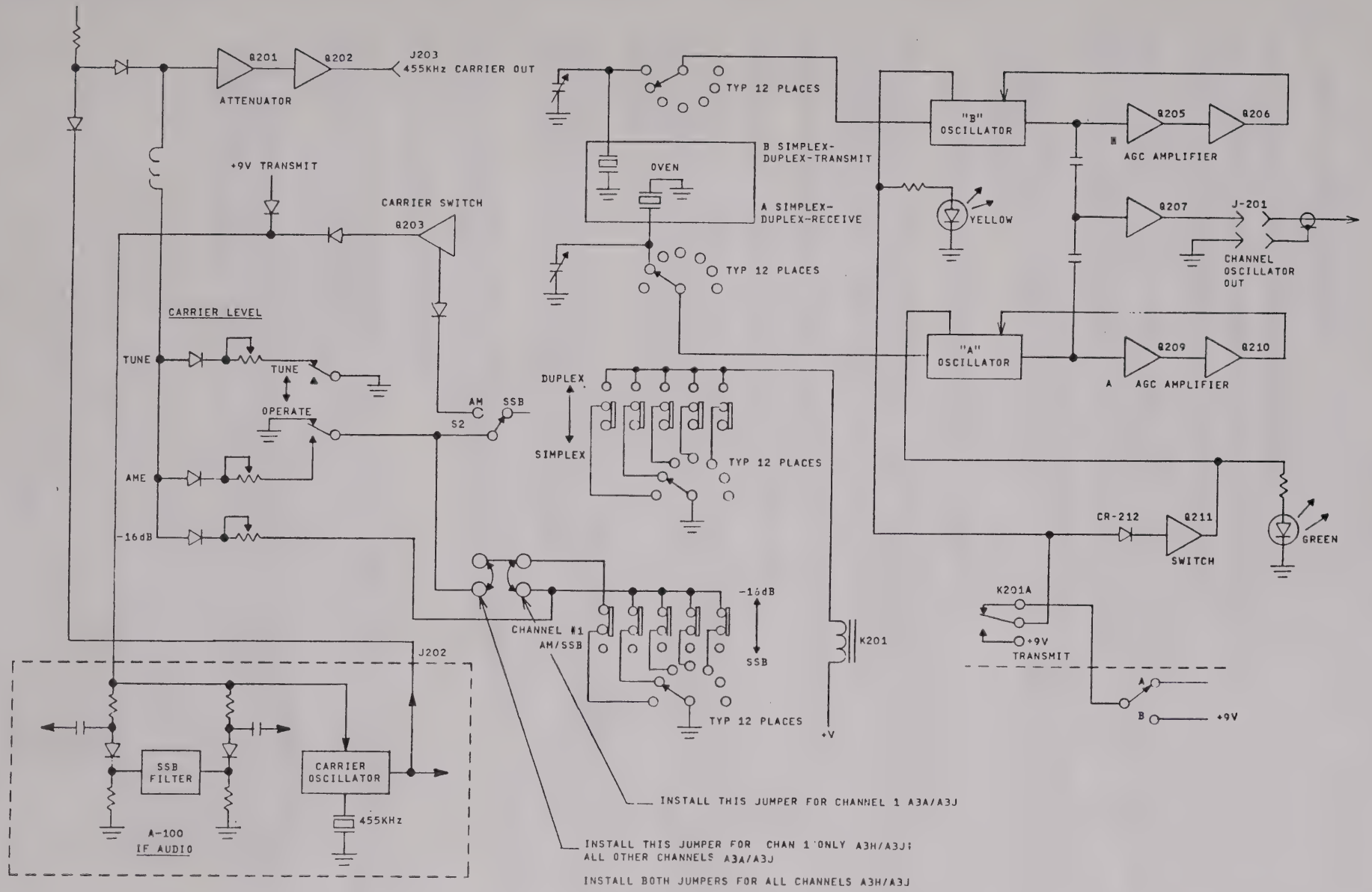
To program a given channel for A3A (-16dB), slide the appropriate switch toward the rear of the set. For A3J (SSB), slide the switch forward.

For channel 1, the switch is factory wired for AME/SSB to allow for the installation of 2182kHz. By use of the appropriate jumpers (Fig. 2 and 11) all channels may be programmed A3A/A3J or A3H/A3J.

For A3A operation, the channel switch is in the -16dB position which enables the -16dB carrier control R213. The resulting current sets the level of carrier with control elements CR202 and Q201 to about 3 watts. On an A3H channel, R211 is enabled. This control is adjusted for about 40 watts of carrier power. +9V TX voltage is applied to the carrier/filter switch so that the carrier oscillator and SSB filter are ALWAYS on in the transmit mode.

An additional feature is provided to facilitate tuning the antenna system. S202, a TUNE/OPERATE switch on the A2 board activates the carrier, set by R209 to about 30 watts.

SYM	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED



QTY	NEXT ASSY	USED ON
		M-1600

Fig. 11

DRAWN	R. Ingus 2-24-77	DATE
CHECKED	[illegible] 4/27/77	
ENG		
M/G	DF 4 27 77	
QA		

APPROVALS

intech INTECH INCORPORATED SANTA CLARA CALIFORNIA, 95050

TITLE: MARINER 1600 MODE & FREQ. CONTROL

SIZE	CODE IDENT NO	DRAWING NO	REV
C	33967	0-157258	A

SCALE NONE SHEET 1 OF 1

6.3 RECEIVE MODE SELECTION

There are two basic modes of operation:

SSB reception using the mechanical filter (A3A and A3J)

AM reception (DSB) using the LC filter on A3H

With Q203 on, the SSB filter and the carrier oscillator are switched in for A3A and A3J operation. On AM, Q203 is turned off by grounding its base thru CR205, disabling the carrier oscillator and enabling the DSB filter.

A front panel mounted switch, S2, allows the operator to select SSB or DSB reception on a A3H channel exclusively. If this feature is not desired, short S2 permanently.

6.4 A/B OSCILLATOR AND SIMPLEX/DUPLEX OPERATION

The Mariner 1600 can accomodate 24 simplex channels or 12 semi-duplex channels or combinations. The only limitation is the necessity to use the same programmable low pass filter for both A and B frequencies.

Programming is quite simple and is described in Chapter 3.

Operation of the A/B switching is as follows:

On SIMPLEX channels, relay K201 is in the non-energized position. Q211 is on by virtue of the voltage divider R236, R237, activating the A oscillator. With the front panel switch A/B (S1) in the B position, the B oscillator in on and Q211 turned off thru CR212.

When DUPLEX operation is programmed, relay K201 is energized and the +9V TX buss switches the oscillators. The A oscillator is active on receive, while the B oscillator is powered up on transmit.

Green and yellow LED's mounted on the front panel and on the A2 board indicate that the A, respective B, oscillator is in use.

6.5 THE CHANNEL OSCILLATORS

Two identical oscillators are on the A2 board. They are controlled by crystals mounted in a proportional control oven. Only the A oscillator is described, since the two are identical.

The oscillator is of the Pierce type using a dual gate MOS-FET, Q208. CR210 furnishes bias to level the output due to the negative voltage applied to gate 1 by rectification. This negative voltage is applied thru CR211 to the gate

of Q201, a DC amplifier. The inverted, positive going voltage is applied thru emitter follower Q210 back to the source of the oscillator, Q208, reducing the output. The RF level, as observed on J201, is set with R231 to about 0.3V pp with a 4-6MHz crystal.

The output of both oscillators is combined thru C213 and C214 to the base of Q207. This stage amplifies the signal to about 0.3V pp for application to the UP-DOWN converter.

7. THE UP-DOWN CONVERTER

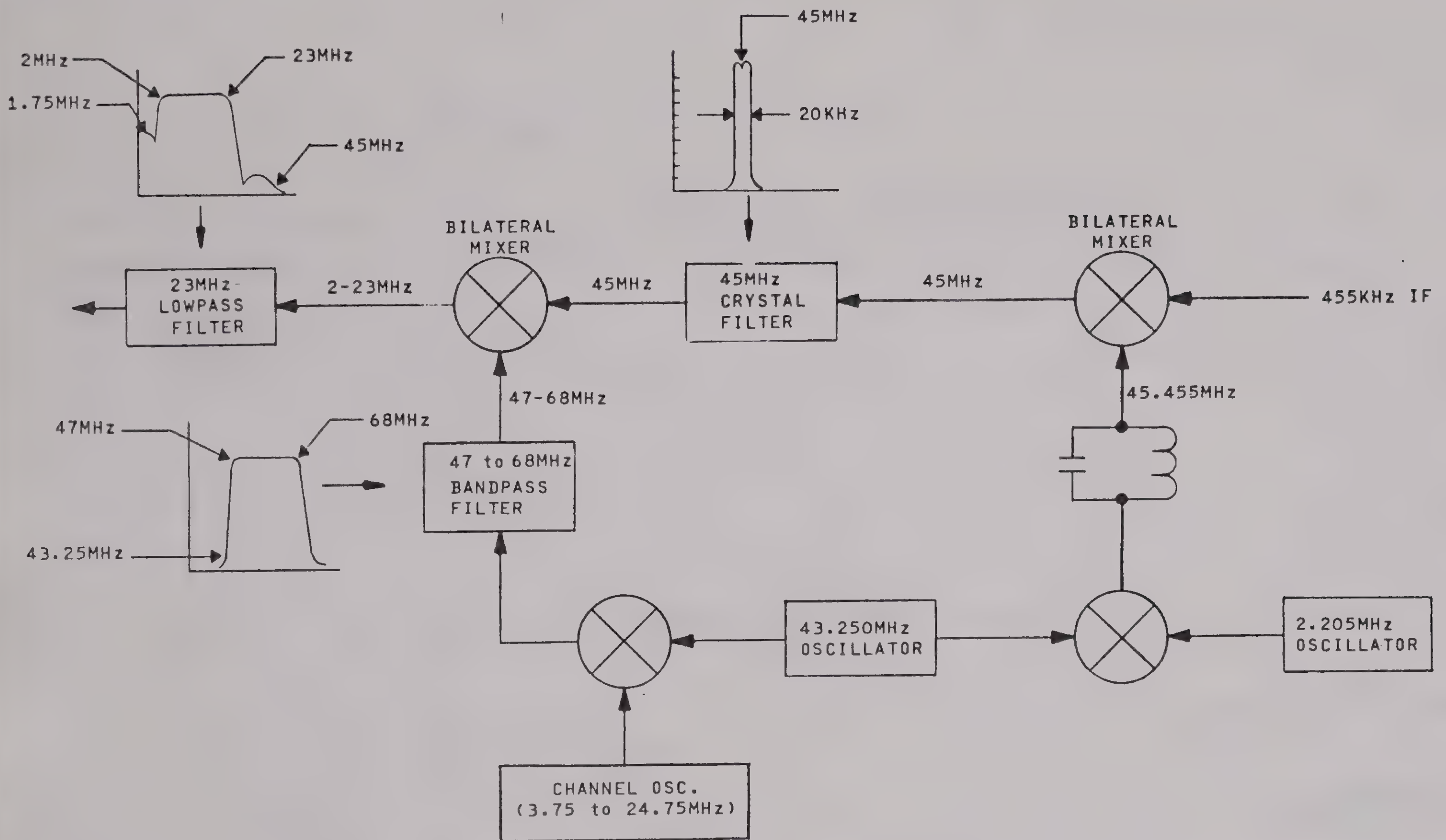
The Mariner 1600 contains a unique UP-DOWN converter. Its advantage is a VHF first IF without the inherent frequency stability problems associated with such an IF.

The channel crystals operate at 1.75MHz above the "carrier" frequency. The channel oscillator frequency ranges, therefore, from 3.75 to 24.75MHz for the set coverage of 2 to 23MHz. This technique allows channel crystals to operate in the fundamental mode over the entire frequency range.

The first IF is 45MHz so that all image frequencies occur above 92MHz and are easily filtered out with a simple low pass filter.

The block diagram is shown in Figure 12, while Figure 13 shows the error cancelling scheme.

REVISIONS					
SYM	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED



THE CONVERTER IS SHOWN IN THE TRANSMIT MODE. SINCE THE SIGNAL PATH MIXERS ARE BILATERAL, RECEIVE MODE MAY BE ARRIVED AT SIMPLY BY REVERSING THE ARROWS IN THE SIGNAL PATH.

Fig. 12

QTY	NEXT ASSY	USED ON
		M-1600

DRAWN: [illegible] DATE: 2-23-7[illegible]
CHECKED: [illegible] 6/14/77
ENG
JF 6 14 77
MFG
QA

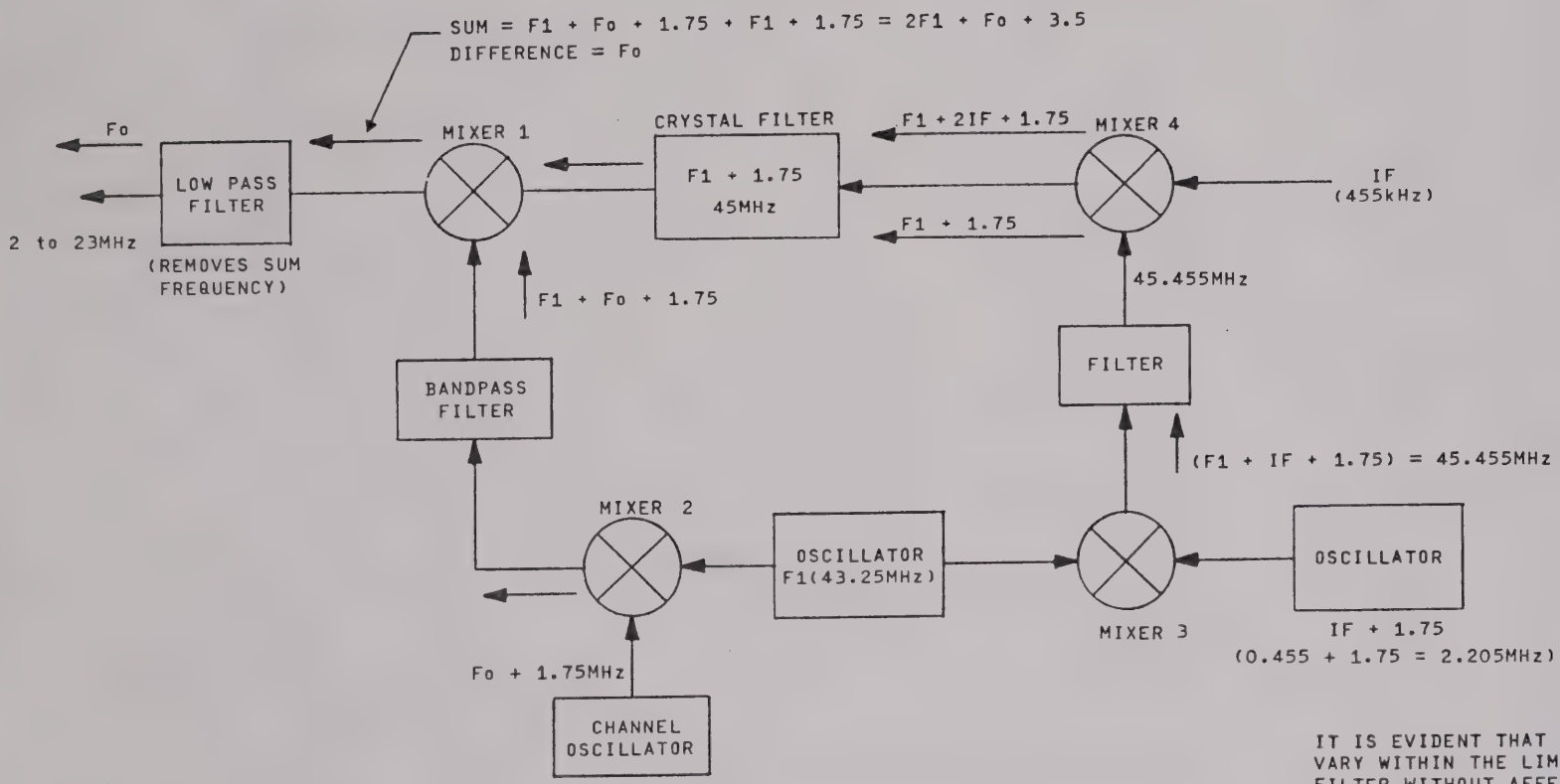
intech — INTECH INCORPORATED, SANTA CLARA, CALIFORNIA, 95050

TITLE: UP-DOWN RF CONVERSION SCHEME BLOCK DIAGRAM. (A4 BOARD)

SIZE	CODE IDENT NO	DRAWING NO	REV
E	33967	0-157259	4

SCALE None SHEET 1 OF 1

REVISIONS					
SYM	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED



IT IS EVIDENT THAT WHEN F1 CANCELS OUT, F1 MAY VARY WITHIN THE LIMITS OF THE NARROWBAND CRYSTAL FILTER WITHOUT AFFECTING THE OUTPUT FREQUENCY (Fo).

QTY	NEXT ASSY	USED ON
		M-1600

Fig. 13

DRAWN P Stage DATE 2-23-77
CHECKED 6/14/77
ENG
JEA 6 14 77
MFG
QA
APPROVALS

intech INTECH INCORPORATED SANTA CLARA CALIFORNIA, 95050

TITLE: UP-CONVERSION AND FREQUENCY ERROR CANCELLING SCHEME

SIZE	CODE IDENT NO	DRAWING NO	REV
B	33967	0-157260	A

SCALE NONE SHEET 1 OF 1

8. THE POWER SUPPLY CIRCUIT

Figure 14 shows a simplified schematic of the power supply circuit. The basic supply is a 13.6V DC negative ground power source. When operation from other voltages is desired, the use of an external power supply is necessary. ON/OFF control for such external accessories, is provided by a remote switch line in the unit (P2, pin 5 and 6).

Once the basic 13.6V DC is provided, it is connected to the set thru the heavy duty power plug, P2, on the rear panel. Two fuses are provided to protect the set in the event of a malfunction. A protection diode, CR3, opens the 25A fuse in the event of reversed polarity.

The ON/OFF switch is part of the volume potentiometer. From this buss, all other voltages are derived either thru the T-R relay or the 9V regulator. The only exception is the high current buss to the final output transistors, which is not switched.

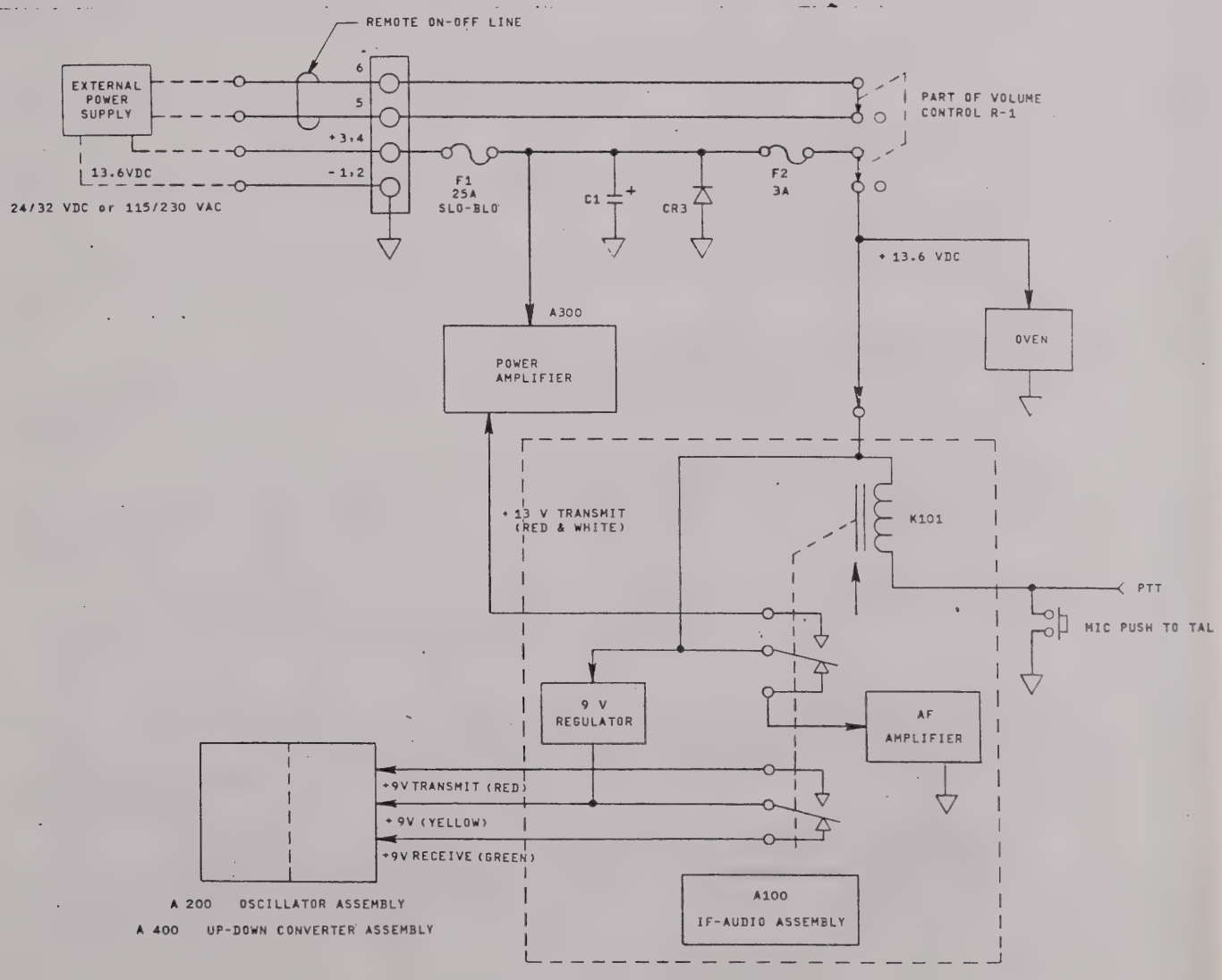


Fig. 14

9. TEST POINT DESCRIPTION, LED MONITORS AND POTENTIOMETER SETTINGS

9.1 GENERAL

Unless other wise noted, measurements should be performed with an oscilloscope and a 10:1 probe. No signal is applied to the antenna. The set is on receive with a crystal in the A oscillator bank and a power supply of 13.6V DC. In the schematic, test points are recognized by the ▽ symbol.

9.2 THE A1 I.F.-AUDIO BOARD

TP1 - Allows the monitoring of the second IF amplifier output which activates the AGC, 455kHz amplitude depends on signal strength received.

TP2 - Monitors the AGC line. Should be set to 3.8-4V DC with R116 under a no signal condition.

TP3 - Accesses the input of the receive 455kHz IF strip and permits checking the T-R switch operation. The test point measures about 3.5V DC on Rx, 0V DC on Tx.

TP4 - Checks the input to the product detector, reads about 0.7V DC. The 455kHz IF signal may be observed with a Rx input.

TP5 - Input to the audio power amplifier. This point reads about 0V DC. There is 50 to 100mV p-p audio needed for full power output.

TP6 - This point allows monitoring the product detector output after a low pass filter attenuates the 455kHz carrier. DC voltage is about 7V.

TP7 - Monitors the 455kHz carrier input to the product detector. Amplitude is about 2.2V p-p. In the AM mode, this point measures 150mV DC.

TP8 - The microphone output after amplification by Q105 and Q106 can be observed at this test point. The audio level is set with potentiometer R143. A typical level is 0.5V p-p centered around 3V DC on Tx.

TP9 - Accesses the input to the filters (AM/SSB) on receive or the output of the SSB filter on transmit. The DC voltage on AM is about 3.4V DC while on SSB, the signal is 4-4.5V DC.

TP10 - This pin permits the checking of the SSB/AM programming that turns on the carrier oscillator and SSB filter. On SSB (Tx and Rx), this point measures about 8-8.5V DC while on AM (Rx only), it reads about 0V DC.

TP11 - The output of the 455kHz filters can be observed on receive or the input of the SSB filter on transmit. DC voltage on receive amounts to 3V, on transmit about 4.7V.

TP12 - This test point allows monitoring of the control input of the audio pre-amplifier/attenuator. The voltage depends on the volume potentiometer and squelch Schmitt Trigger. Full attenuation occurs at about +6V DC while about 12dB gain results with about +2V DC. The Schmitt Trigger induces a step change of about 1V.

CR114 - A green LED indicates that the T-R relay is in the receive mode.

CR115 - A red LED indicates that the T-R relay is in the transmit mode.

CR117 - A yellow LED indicates that the 9V regulator is under power.

R116 - Sets the AGC threshold on receive. Monitor TP2 and set to 3.8-4.0V DC.

R143 - Sets the microphone amplifier gain. Set to about 0.5V p-p audio on TP8.

9.3 THE A2 OSCILLATOR BOARD

TP1-J201 - Allows the measurement of the channel oscillator frequency. This frequency is 1.75000MHz higher than the surpressed carrier frequency. The amplitude with a 4-6MHz crystal is set with R231/R220 to 0.3-0.4V p-p.

CR217 - A green LED indicates that the "A" oscillator is in service and therefore the front bank of the trimmers will have an effect on frequency. CR3 on the front panel is connected in parallel.

CR216 - A yellow LED indicates that the "B" oscillator is powered up and the rear variable capacitor bank is used to set the crystals on frequency. CR2 on the front panel is connected in parallel.

R209 - With S202, the Tune/Operator switch, in the tune postion, R209 is set to 30W. This allows the tuning of the antenna coupler without damage to the final stage even with prolonged high VSWR values present.

R211 - On a A3A channel, set this control to about 3W carrier output (-16dB below PEP).

R213 - In the A3H mode, set to 40-50W carrier power (3-6dB below PEP).

1.7500
2.182
3.932

9.4 THE A3 RF POWER AMPLIFIER

R313 - Sets the idling current of the output stage. With no modulation this control is adjusted for a combined collector current of about 200mA (Q303, Q304).

Note: Set for minimum IM distortion with a two tone signal if a spectrum analyzer is available.

R325 - Sets the ALC attack point. Channel up the transceiver on several frequencies; e.g., 2, 4, 8, 12, 16, and 22MHz. With R325 totally counter-clockwise; e.g., no feedback, assure yourself of at least 150W PEP on every frequency into a 50 ohm dummy load. R409 may need to be readjusted if 150W PEP is not achieved on each frequency. Start rotating R325 until the correct setting is found when the power just starts dropping.

R326 - Measure DC voltage across R308. Set R326 with no crystal installed to 0.25V DC.

9.5 THE A4 UP-DOWN CONVERTER

TP1 - Hook up a frequency counter at the junction of R432 and Q411 to monitor the 2.205MHz oscillator. The amplitude is about 0.6V p-p centered around 1.2V DC.

R409 - Controls the RF gain in the transmit chain. Whistle into microphone and set to about 100W PEP on a 22MHz channel. See also the R325 paragraph for the entire Tx chain set up.

R439 - Sets the 2.205MHz frequency on transmit. Monitor TP1 with counter and set to 2.20500MHz on transmit. C411 is factory selected for 2.205000MHz to occur at about midrange of clarifier pot on receive.

C450 - Inject a 17.50MHz 1-5mV rms signal on receive and adjust C450 for minimum audio output.

LIST OF COMPONENTS

I.F. AUDIO MODULE, A1

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
1008 XXXX	4	Cap., SELECT	C110,111,112,129	
1008 0047	1	Cap., .001µF, 50V	C149	
1008 0055	11	Cap., .01µF, 50V	C101,106,107,115,116, 121,131,135,137,139, 151	
1008 0059	5	Cap., .047µF, 50V	C124,127,128,132,155	
1008 0061	24	Cap., .1µF, 25V	C103,108,109,117-120, 122,123,126,133,134, 136,138,142,144,147, 148,157,158,159,162, 168,175	
1008 0065	1	Cap., .005µF, 100V	C161	
1008 1178	1	Cap., .002µF, 50V	C145	
1012 0009	3	Cap., 220µF	C146,170,171	
1024 0132	1	Cap., 130pF	C125	
1024 0142	1	Cap., 330pF, 5%	C150	
1024 0143	2	Cap., 360pF	C104,105	
1024 0150	1	Cap., 620pF, 5%	C165	
1044 0300	2	Cap., 10µF, 35V	C156,160	
1044 0304	5	Cap., 2.2µF, 35V	C102,130,152,154,167	
1044 0311	6	Cap., 22µF, 16V	C140,141,143,153,169, 173	
1050 0103	2	Cap., 2.2pF	C113,114	
1106 0102	1	Cap., Var., 2-20pF	C166	
1200 0544	5	Coil, 470µH	L101,102,103,104,105	
1200 0678	1	Coil, 33µH	L106	
1200 1030	1	Transformer	T104	
1200 1035	2	Transformer	T102,105	
1200 1036	1	Transformer, 455kHz	T106	
1200 1038	2	Transformer	T101,103	
1200 1039	1	Transformer	T107	
1600 1011	1	Crystal, 455kHz	Y101	
1800 0005	1	Filter, Mech., 455kHz	FL101	

LIST OF COMPONENTS

I.F. AUDIO MODULE, A1 (Continued)

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
1900 0016	1	LED, Yellow	CR117	
1900 0018	1	LED, Green	CR114	
1900 0019	1	LED, Red	CR115	
2518 1128	1	Res., 1.2Ω, 1/4W, 10%	R133	
2518 2100	1	Res., 10Ω, 1/4W, 10%	R137	
2518 2470	3	Res., 47Ω, 1/4W, 10%	R142,144,145	
2518 2560	1	Res., 56Ω, 1/4W, 10%	R134	
2518 3101	1	Res., 100Ω, 1/4W, 10%	R135	
2518 3151	1	Res., 150Ω, 1/4W, 10%	R147	
2518 3221	1	Res., 220Ω, 1/4W, 10%	R151	
2518 3271	1	Res., 270Ω, 1/4W, 10%	R138	
2518 3471	8	Res., 470Ω, 1/4W, 10%	R112,139,150,154,155, 156,157,160	
2518 3681	3	Res., 680Ω, 1/4W, 10%	R106,107,115	
2518 3821	1	Res., 820Ω, 1/4W, 10%	R129	
2518 4122	1	Res., 1.2k, 1/4W, 10%	R127	
2518 4182	3	Res., 1.8k, 1/4W, 10%	R102,103,121	
2518 4222	5	Res, 2.2k, 1/4W, 10%	R101,105,128,130,141	
2518 4332	1	Res., 3.3k, 1/4W, 10%	R108	
2518 4472	6	Res., 4.7k, 1/4W, 10%	R104,111,122,131,132, 136	
2518 5103	3	Res., 10k, 1/4W, 10%	R109,110,117	
2518 5123	1	Res., 12k, 1/4W, 10%	R126	
2518 5223	1	Res., 22k, 1/4W, 10%	R113	
2518 5823	1	Res., 82k, 1/4W, 10%	R148	
2518 6104	7	Res., 100k, 1/4W, 10%	R118,119,120,125,149, 159,162	
2518 6224	2	Res., 220k, 1/4W, 10%	R123,140	
2518 6474	1	Res., 470k, 1/4W, 10%	R124	
2518 8106	1	Res., 10M, 1/4W, 10%	R114	

LIST OF COMPONENTS

I.F. AUDIO MODULE, A1 (Continued)

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
2702 0424	1	Res., Var., 10k Pot	R116	
2702 0426	1	Res., Var., 100k Pot	R143	
2810 0102	11	Diode, 1N4148	CR101-108,110,112,113	
2810 0188	1	Diode, 1N4739A	CR116	
2810 0288	1	Diode, 1N4732	CR111	
2820 0128	1	FET, U1898E	Q101	2820 0124 2N4392
2850 0178	1	Audio Amp, TBA 810AS	U107	
2850 0192	2	I.F. Amp, MC1350P	U101,102	
2850 0194	2	Attenuator, MC3340P	U105,106	
2860 0109	1	Balanced Modulator, SN76514N	U104	
2870 0127	4	Transistor, 2N3565	Q103,104,105,106	2870 0101 2N2484
2870 0244	2	Transistor, MPS A14	Q102,107	
2870 0245	1	Transistor, TIP 120	Q108	
3001 0039	1	T/R Relay	K101	
3200 0002	1	Heater	OV101	

LIST OF COMPONENTS

OSCILLATOR ASSEMBLY, A2

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
1008 0047	1	Cap., .001μF, 50V	C203	
1008 0055	5	Cap., .01μF, 100V	C201,202,204,216,221	
1008 0061	8	Cap., .1μF, 25V	C206,215.217-220,223, 224	
1024 0107	1	Cap., 10pF	C222	
1024 0112	2	Cap., 22pF	C209,211	
1024 0115	2	Cap., 30pF	C210,212	
1024 0120	2	Cap., 47pF	C207,208	
1044 0300	1	Cap., 10μF, 35V	C205	
1050 0107	2	Cap., 3.3pF	C213,214	
1106 0102	24	Cap., 2-20pF	C225-248	
1200 0544	3	Inductor, 470μH	L201-203	
1200 0678	1	Inductor, 33μH	L204	
1200 1033	1	Transformer, RF	T201	
1900 0016	1	LED, Yellow	CR216	
1900 0018	1	LED, Green	CR217	
2518 2330	1	Res., 1/4W, 10%, 33Ω	R225	
2518 3151	2	Res., 1/4W, 10%, 150Ω	R201,207	
2518 3271	2	Res., 1/4W, 10%, 270Ω	R210,212	
2518 3471	5	Res., 1/4W, 10%, 470Ω	R214,234,238,240,241	
2518 3681	2	Res., 1/4W, 10%, 680Ω	R222,233	
2518 3821	3	Res., 1/4W, 10%, 820Ω	R202,235,239	
2518 4102	1	Res., 1/4W, 10%, 1K	R203	
2518 4332	3	Res., 1/4W, 10%, 3.3K	R206,236,242	
2518 4472	1	Res., 1/4W, 10%, 4.7K	R224	
2518 4682	2	Res., 1/4W, 1/%, 6.8K	R218,219	
2518 5103	5	Res., 1/4W, 10%, 10K	R205,208,221,232,237	
2518 5223	1	Res., 1/4W, 10%, 22K	R223	
2518 5473	5	Res., 1/4W, 10%, 47K	R204,215,216,226,227	
2518 6104	2	Res., 1/4W, 10%, 100K	R217,228	
2518 7105	2	Res., 1/4W, 10%, 1M	R219,230	
2702 0430	3	Res., 1/4W, 500Ω POT	R209,211,213	

LIST OF COMPONENTS

OSCILLATOR ASSEMBLY, A2 (Continued)

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
2702 0424	2	Res., 1/4W, 10K POT	R220,231	
2810 0102	17	Diode, 1N4148	CR201-215,218,219	
2820 0128	3	Transistor, FET U1898E	Q201,205,209	
2833 0011	2	Transistor, 3N212	Q204,208	2820 0124 2N4393
2870 0127	1	Transistor, 2N3565	Q202	
2870 0242	1	Transistor, 2N3641	Q207	2870 0101 2N2484
2870 0244	3	Transistor, MPS-A14	Q203,206,210	2870 0139 2N2219A
2870 0247	1	Transistor, 2N5142	Q211	2870 0139 2N2219A
3001 0040	3	Switch, PCB	S201A,201B,201C	2870 0111 2N2907A
3001 0045	1	Switch, Tune/Operate	S202	
3001 0059	1	Relay	K201	
3001 0060	4	Dip Switch	S203,206	
3200 0001	1	Ovens, Crystal	OV201	
1430 5027	1	Phono Jack	J201	

LIST OF COMPONENTS

POWER AMPLIFIER ASSEMBLY, A3

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
1006 1362	4	Cap., Mono. .1µF,100V	C314-317	
1008 1155	2	Cap., Disc .01µF, 50V	C306,307	
1008 1174	14	Cap., Disc .1µF, 16V	C302,303,308-311,318, 319,320,322,323,325, 326,327	
1024 0169	1	Cap., DM19 330pF	C332	
1024 0170	2	Cap., DM19 620pF	C333,334	
1024 0171	1	Cap., DM19 1200pF	C331	
1024 0175	1	Cap., DM19 1000pF	C330	
1044 0300	3	Cap., Tant. 10µF, 16V	C301,304,324	
1044 0304	1	Cap., Tant. 2.2µF, 25V	C321	
1044 0311	1	Cap., Tant. 22µF, 16V	C312	
1044 0313	2	Cap., Tant. 22µF, 25V	C328,329	
1200 0043	1	Inductor, 4 Beads	L302	
1200 0044	2	4 turns #18 wound on R309 and R310	L303,304	
1200 0053	1	Inductor,Shielded,.33µH	L301	
1200 1040	1	Transformer, Input	T301	
1200 1041	1	Transformer, Predriver	T302	
1200 1042	1	Transformer, Driver	T303	
1200 1043	1	Transformer, Output	T304	
1430 5027	1	Connector	J301	
1430 5042	1	Connector	J302	
2518 1478	1	Res,1/4W,10%, 4.7Ω	R308	
2518 2100	1	Res,1/4W,10%, 10Ω	R323	
2518 2330	1	Res,1/4W,10%, 33Ω	R302	
2518 2820	1	Res,1/4W,10%, 82Ω	R301	
2518 3151	2	Res,1/4W,10%, 150Ω	R320,322	
2518 3271	2	Res,1/4W,10%, 270Ω	R304,321	
2518 3471	1	Res,1/4W,10%, 470Ω	R312	
2518 3681	1	Res,1/4W,10%, 680Ω	R305	
2518 4102	2	Res,1/4W,10%, 1K	R317,318	

LIST OF COMPONENTS

POWER AMPLIFIER ASSEMBLY, A3 (Continued)

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
2518 4272	1	Res., 1/4W, 10%, 2.7K	R306	
2522 2680	1	Res., 1/2W, 5%, 68Ω	R307	
2522 3271	2	Res., 1/2W, 5%, 270Ω	R311,324	
2540 2220	2	Res., 2W, 10%, 22Ω	R309,310	
2542 2100	1	Res., 2W, 5%, 10Ω	R316	
2702 0426	1	Res., Variable, 100K	R325	
2702 0429	1	Res., Variable, 10Ω	R313	
2810 0102	2	Diode, 1N4148	CR303,304	
2810 0190	1	Diode, 1N4740A	CR302	
2810 0234	1	Didoe, 1N4004	CR301	
2870 0127	1	Transistor, 2N3565	Q306	
2870 0175	1	Transistor, 2N3866	Q301	
2870 0245	1	Transistor, TIP 120	Q307	
2870 0248	1	Transistor, TIP 31	Q305	
2870 0250	2	Transistor, SD1076	Q303,304	Matched Pair
2870 0277	1	Transistor, RF2092	Q302	

LIST OF COMPONENTS

UP-DOWN CONVERTER, A4

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
1006 0037	7	Cap, .01µF, 100V	C424,433,440,441,451, 452,459	
1008 0047	4	Cap, .001µF, 50V	C421,448,453,456	
1008 0059	24	Cap, .047µF, 50V	C401-410,415,416,423, 428,430,432,434,435, 438,442,447,454 455,465	
1024 0109	3	Cap, 15pF	C414,419,429	
1024 0112	5	Cap, 22pF	C420,431,436,437,443	
1024 0114	1	Cap, 27pF	C427	
1024 0115	2	Cap, 30pF	C417,418	
1024 0120	1	Cap, 47pF	C458	
1024 0125	3	Cap, 68pF	C439,446,449	
1024 0127	1	Cap, 82pF	C422	
1024 0129	2	Cap, 100pF	C411,413	
1024 0133	4	Cap, 150pF	C425,426,445,457	
1024 0134	1	Cap, 160pF	C444	
1024 0139	1	Cap, 250pF	C412	
1024 XXXX	1	Cap, Select	C464	
1050 0105	2	Cap, 6.8pF	C460,461	
1050 0107	2	Cap, 3.3pF	C462,463	
1106 0102	1	Cap, 2-20pF	C450	
1200 0502	1	Inductor .15µH	L411	
1200 0509	2	Inductor,Shielded .56µH	L403,404	
1200 0520	1	Inductor 4.7µH	L410	
1200 0536	1	Inductor 100µH	L407	
1200 0544	3	Inductor 470µH	L401,406,417	
1200 0678	7	Inductor 33µH	L408,409,412-416	
1200 0051	2	Inductor, T30-2 Core 6 Turns	L402,405	
1200 0052	1	Inductor, 3 Beads	L418	
1200 1033	1	Transformer	T401	
1200 1035	1	Transformer	T410	

LIST OF COMPONENTS

UP-DOWN CONVERTER, A4 (Continued)

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
1200 1050	6	Transformer	T402,403,404,407,408, 409	
1200 1051	2	Transformer	T405,406	
1430 5027	1	Connector	J401	
1600 1016	1	Crystal, 2.205MHz	Y401	
1600 1017	1	Crystal, 43.38MHz	Y402	
1800 0009	1	Filter,Monolithic 45MHz	FL401	
	1	Assembly, 47.68MHz Bandpass Filter	FL402, Part of PC Board	See FL402 Parts List
1810 0102	2	Bal. Mixer MCL-SRA-1	U401,402	
2518 2100	1	Res.,1/4W,10%, 10Ω	R401	
2518 2150	1	Res.,1/4W,10%, 15Ω	R416	
2518 2330	1	Res.,1/4W,10%, 33Ω	R425	
2518 2470	2	Res.,1/4W,10%, 47Ω	R407,421	
2518 3101	2	Res.,1/4W,10%, 100Ω	R424,432	
2518 3151	1	Res.,1/4W,10%, 150Ω	R419	
2518 3221	3	Res.,1/4W,10%, 220Ω	R408,410,442	
2518 3271	1	Res.,1/4W,10%, 270Ω	R404	
2518 3331	2	Res.,1/4W,10%, 330Ω	R422,440	
2518 3471	6	Res.,1/4W,10%, 470Ω	R403,406,415,418,431, 435	
2518 3681	1	Res.,1/4W,10%, 680Ω	R426	
2518 4102	2	Res.,1/4W,10%, 1K	R405,420	
2518 4222	2	Res.,1/4W,10%, 2.2K	R402,417	
2518 4332	1	Res.,1/4W,10%, 3.3K	R434	
2518 4472	5	Res.,1/4W,10%, 4.7K	R412,414,428,430,443	
2518 5103	5	Res.,1/4W,10%, 10K	R411,413,427,429,433	
2518 5223	1	Res.,1/4W,10%, 22K	R441	
2518 5473	1	Res.,1/4W,10%, 47K	R438	
2518 6104	2	Res.,1/4W,10%, 100K	R436,437	
2702 0425	1	Res.,Variable, 25K	R439	
2810 0102	7	Diode, 1N4148	CR401-404,407,408,410	
2810 0208	2	Varactor, MV3103	CR409,411	
2702 0422	1	Res.,Variable, 100Ω	R409	

LIST OF COMPONENTS

UP-DOWN CONVERTER, A4 (Continued)

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
2810 0290	2	Diode, Hot Carrier	CR405,406	
2833 0011	1	Transistor, FET 3N212	Q412	
2860 0109	1	Bal.Modulator SN76514N	U403	
2870 0126	3	Transistor, 2N3563	Q402,403,411	2870 0188 PN3563
2870 0155	2	Transistor, 2N918	Q404,408	
2870 0175	1	Transistor, 2N3866	Q406	
2870 0242	4	Transistor, 2N3641	Q401,407,409,410	2870 0139 2N2219A
2870 0258	1	Transistor, MPSH07	Q405	
3200 0002	1	Oven, HC-6	OV401	

LIST OF COMPONENTS

FL 402 FILTER

1024 0110	3	Cap. Mica. 18pF	C6,8,9	
1024 0112	1	Cap. Mica. 22pF	C8	
1024 0115	5	Cap. Mica. 30pF	C1-5	
1024 0120	2	Cap. Mica. 47pF	C10,11	
1200 0502	1	Matched Set of 5 .15µH Inductors, Shielded	C1-5	

LIST OF COMPONENTS

CHASSIS ASSEMBLY

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
0710 0003	1	Speaker	LS1	
0710 0014	1	Microphone, Carbon	MIC1	0710 0019
1012 0012	1	Cap., 1000µF, 16V	C1	Dynamic
1420 0006	1	Fuse Holder	XF2	
1420 0014	1	Fuse Holder	XF1	
1420 0015	2	Lamp Holder	XDS1,2	
1430 0029	2	Connector, UHF	J3,4	
1430 5038	1	Connector, Ant. Coupler	P1	
1430 5039	1	Connector, Power	P2	
1430 5040	1	Connector, Power	J2 Chassis Mount	
1430 5041	1	Connector, Ant. Coupler	J1 Chassis Mount	
1460 0002	1	Barrier Strip	TB1	
1900 0016	1	LED, Yellow	CR1	
1900 0018	1	LED, Green	CR2	
1900 0020	1	Lamp	DS1	GE 53
1900 0021	1	Lamp, Red	DS2	GE 53R
2518 3471	2	Res., 470Ω, 1/4W, 10%	R11,12	
2518 4102	1	Res., 1k, 1/4W, 10%	R8	
2518 4222	2	Res., 2.2k, 1/4W, 10%	R4,9	
2518 4472	3	Res., 4.7k, 1/4W, 10%	R5,6,7	
2518 5223	1	Res., 22k, 1/4W, 10%	R10	
2700 0015	1	Res. Var., 25k w/Switch	R1 (S1)	
2700 0016	2	Res. Var., 10k w/Switch	R1 (S2), R3 (S3)	2810 0189
2810 0283	1	Diode, 1N5402	CR3	1N5400
2810 0286	1	Varistor, V22ZA1	CR4	
3001 0046	2	Switch, SPDT	S4,5	A/B & AME/SSB
3002 0014	1	Fuse, Slo-Blo, 25 Amp	F1	
3002 0015	1	Fuse, Fast Blo, 3 Amp	F2	
5500 1099	1	Dial	Channel Indicator	
5515 7164	1	Knobs, Volume		
5515 7165	1	Knobs, Clarity & Squelch		

LIST OF COMPONENTS

CHASSIS ASSEMBLY (Continued)

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.
5115 7237	1	Shaft		
5515 7166	1	Knobs, Select		
5070 0046	1	Coupling		
5315 7037	1	Frequency Label		
9115 7128	1	Low Pass Filter Assy	A5 Board	
5010 4506	2	Mounting Knobs		
5010 4507	2	Mounting Screws		
9115 7050	1	A1 Board Assembly		
9115 7258	1	A2 Board Assembly		
9115 7262	1	A3 Board Assembly		
9115 7259	1	A4 Board Assembly		
9115 7372	1	A5 Board Assembly		

PART NO.	QTY	DESCRIPTION	REF. DESIG.	REMARKS MFG./SUB.